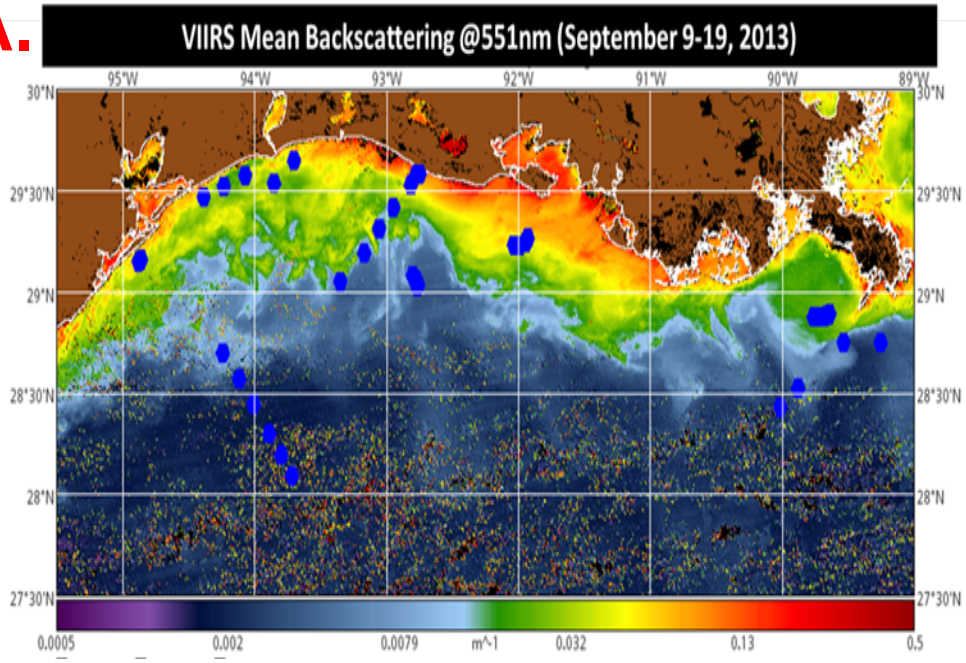
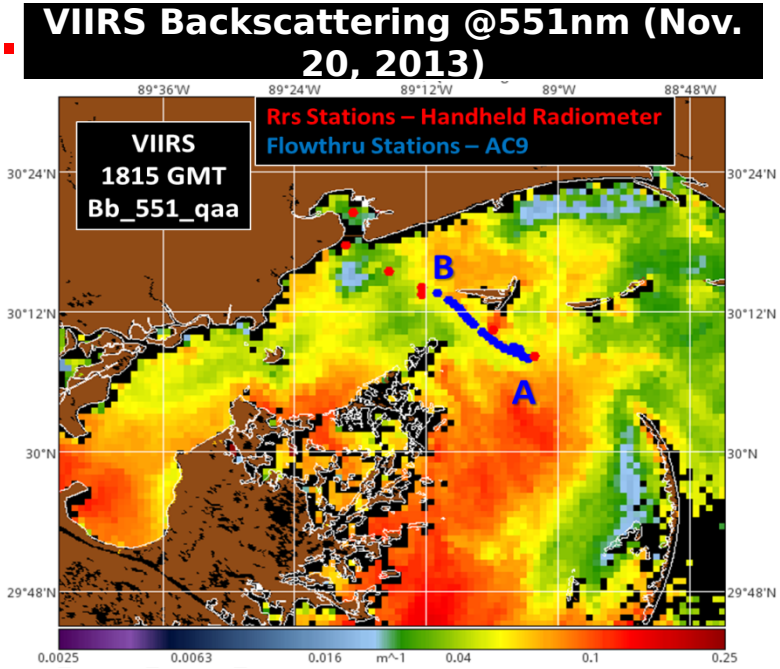
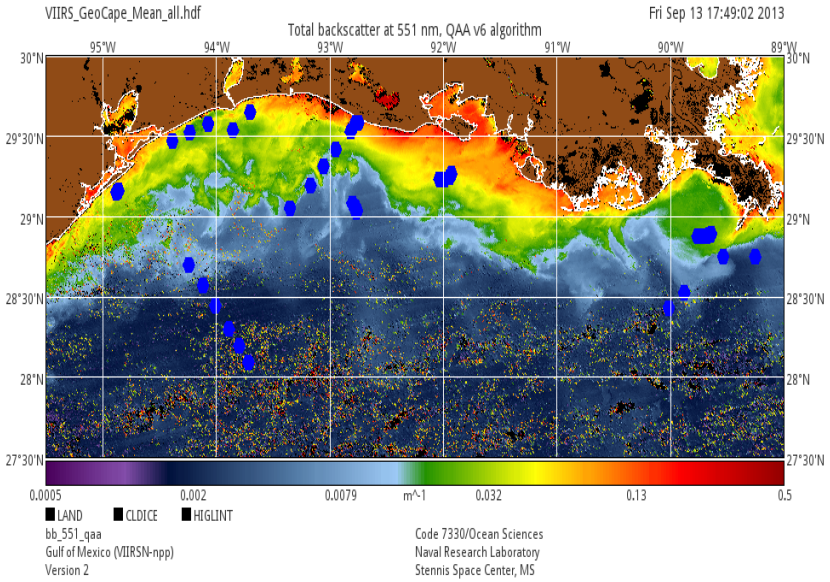
A.

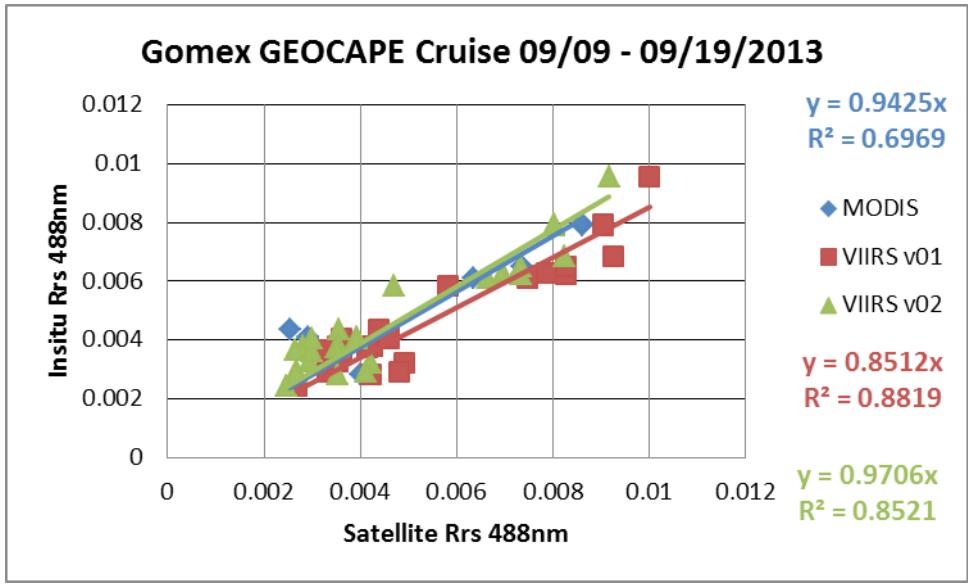

VIIRS Mean Backscattering @551nm (September 9-19, 2013)
95°W
94°W
93°W
92°W
91°W
90°W
89°W
30°N
29°30'N
29°N
28°30'N
28°N
27°30'N
0.0005
0.002
0.0079
m^-1
0.032
0.13
0.5

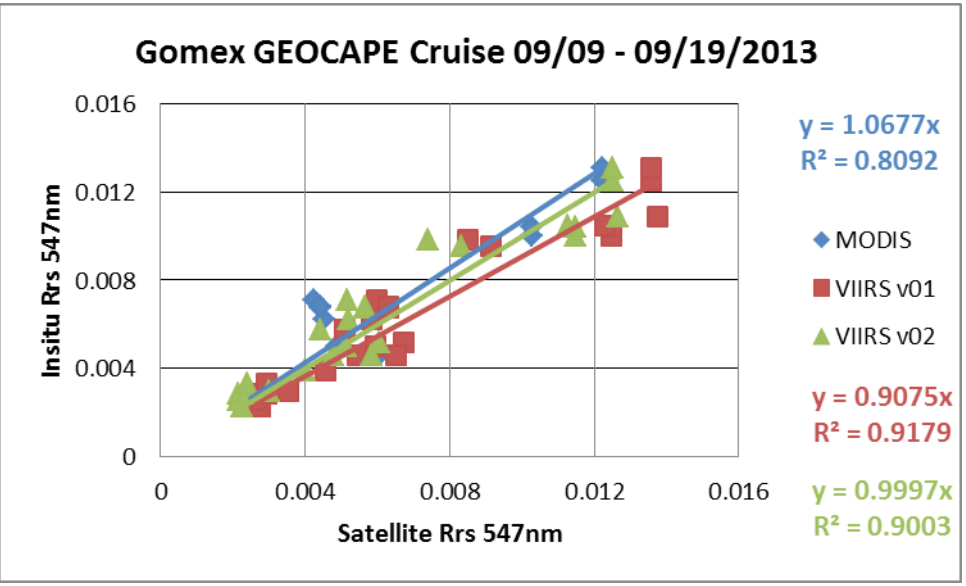
B.


VIIRS Backscattering @551nm (Nov. 20, 2013)
Rrs Stations – Handheld Radiometer
Flowthru Stations – AC9
VIIRS
1815 GMT
Bb_551_qaa
B
A
89°36'W
89°24'W
89°12'W
89°W
88°48'W
30°24'N
30°12'N
30°N
29°48'N
0.0025
0.0063
0.016
m^-1
0.04
0.1
0.25

GEOCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Scat





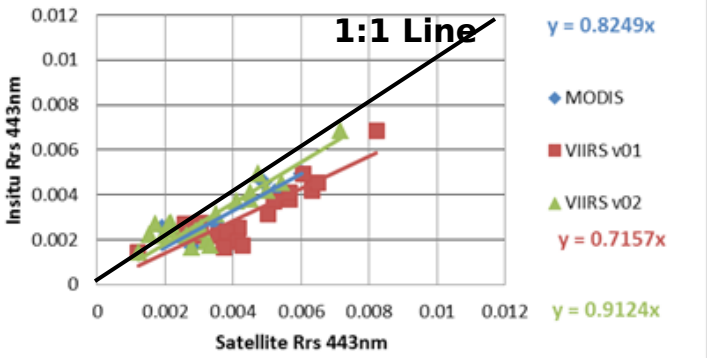


Slope	rrs412	rrs443	rrs488	rrs547
MODIS	0.85	0.82	0.94	1.07
VIIRS v01	0.5	0.72	0.85	0.91
VIIRS v02	0.79	0.91	0.97	0.99

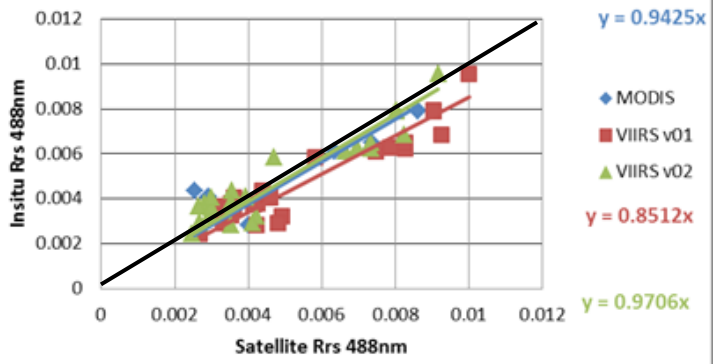
Rsquared	rrs412	rrs443	rrs488	rrs547
MODIS	0.91	0.86	0.85	0.86
VIIRS v01	0.44	0.77	0.89	0.92
VIIRS v02	0.40	0.78	0.88	0.92

Insitu: UMASS/NOAA

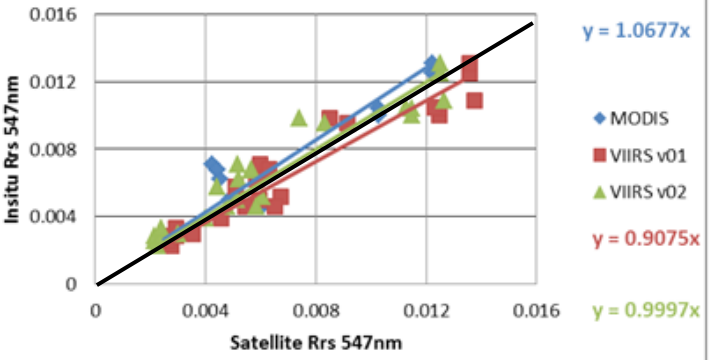
A.



B.



C.



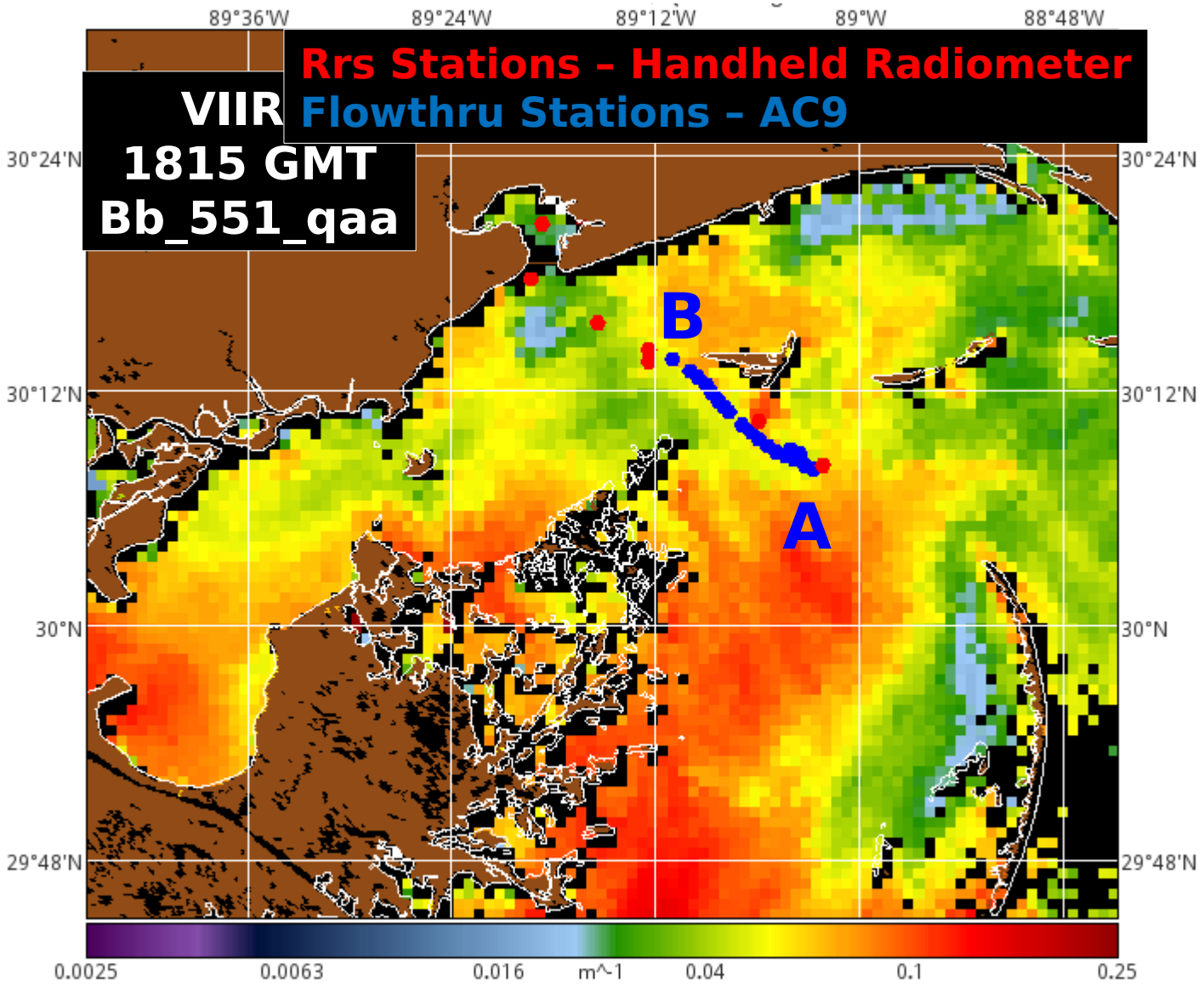
D.

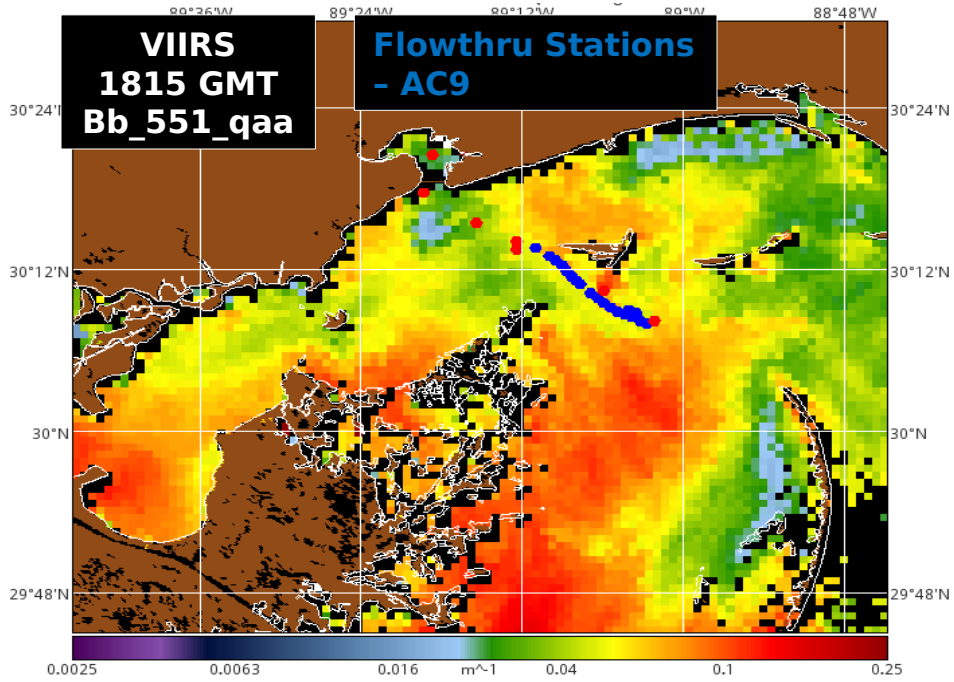
Slope	rrs412	rrs443	rrs488	rrs547	rrs667
MODIS	0.85	0.82	0.94	1.07	1.18
VIIRS v01	0.5	0.72	0.85	0.91	0.79
VIIRS v02	0.79	0.91	0.97	0.99	0.85

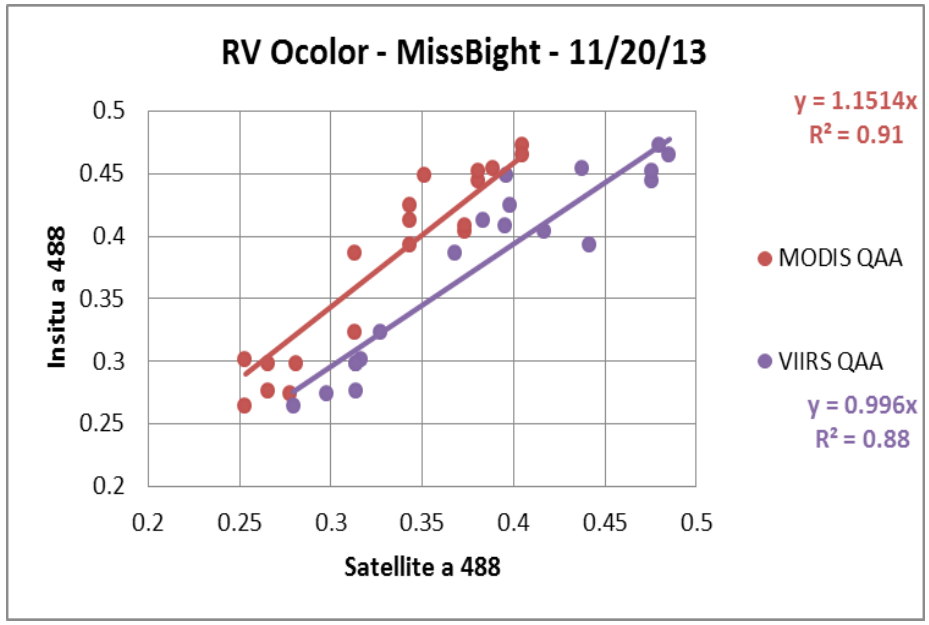
Rsquared	rrs412	rrs443	rrs488	rrs547	rrs667
MODIS	0.9852	0.9800	0.9692	0.9713	0.9720
VIIRS v01	0.9059	0.9668	0.9841	0.9826	0.9582
VIIRS v02	0.8768	0.9638	0.9801	0.9788	0.9573

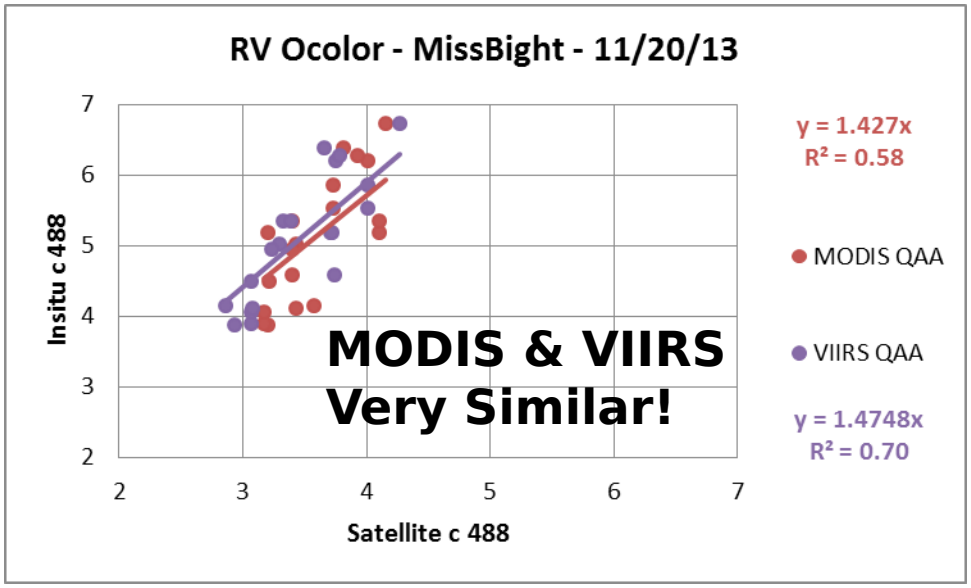
Insitu: UMASS (Lee) & NOAA (Ondrusek)

25 Valid Matchups


Rrs Stations – Handheld Radiometer
Flowthru Stations – AC9
VIIR
1815 GMT
Bb_551_qaa
89°36'W
89°24'W
89°12'W
89°W
88°48'W
30°24'N
30°12'N
30°N
29°48'N
B
A
0.0025
0.0063
0.016
m^-1
0.04
0.1
0.25

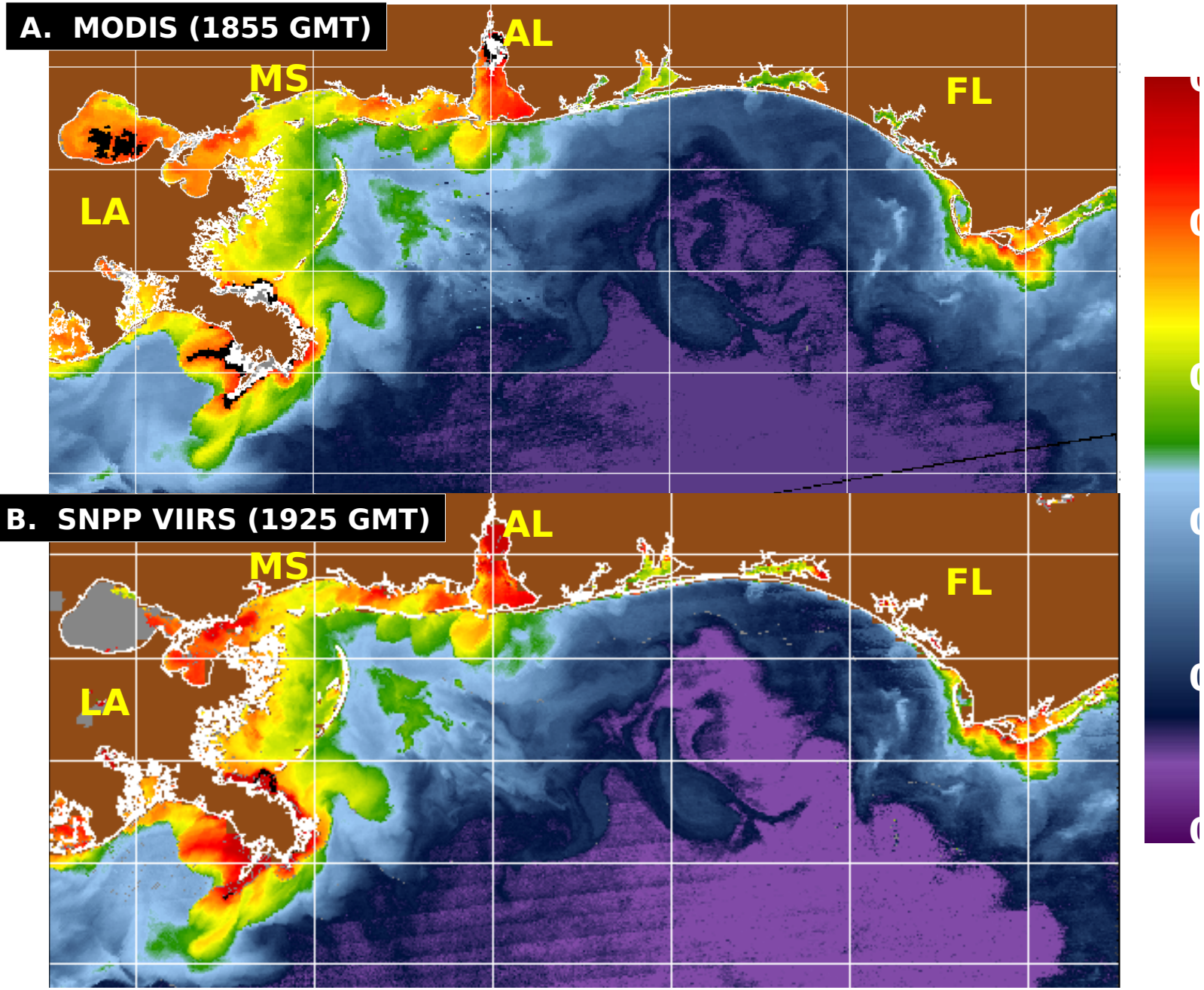




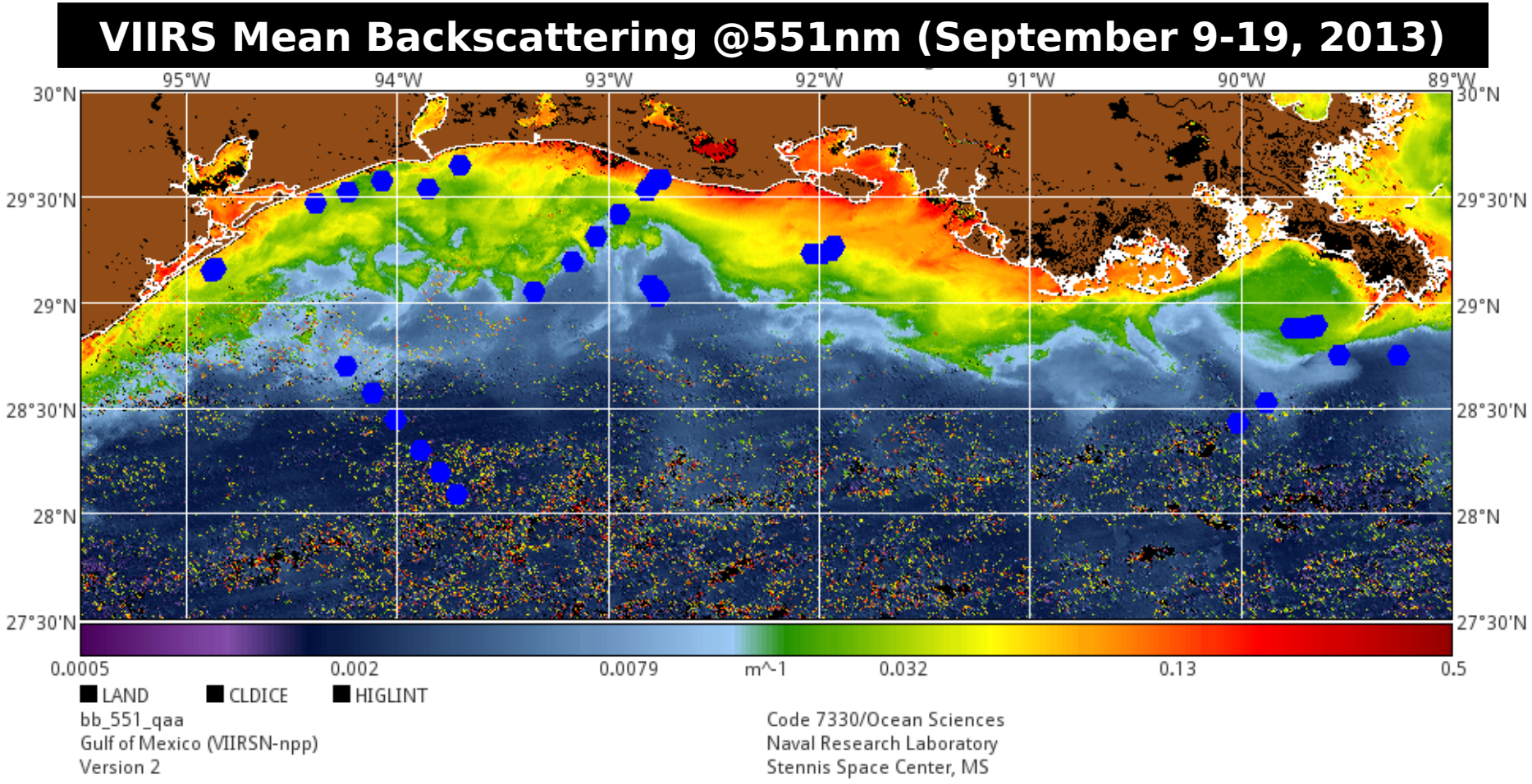


19 Stations

SLOPE	a412	a443	a488	a547	c412	c443	c488	c547
MODQAA	1.48	1.38	1.15	0.88	1.41	1.43	1.43	1.43
VIIRSQAA	0.85	1.05	0.99	0.83	1.37	1.47	1.48	1.47
R2	a412	a443	a488	a547	c412	c443	c488	c547
ModQAA	0.90	0.91	0.91	0.84	0.59	0.59	0.58	0.58
VIIRSQAA	0.80	0.90	0.88	0.79	0.71	0.72	0.70	0.70

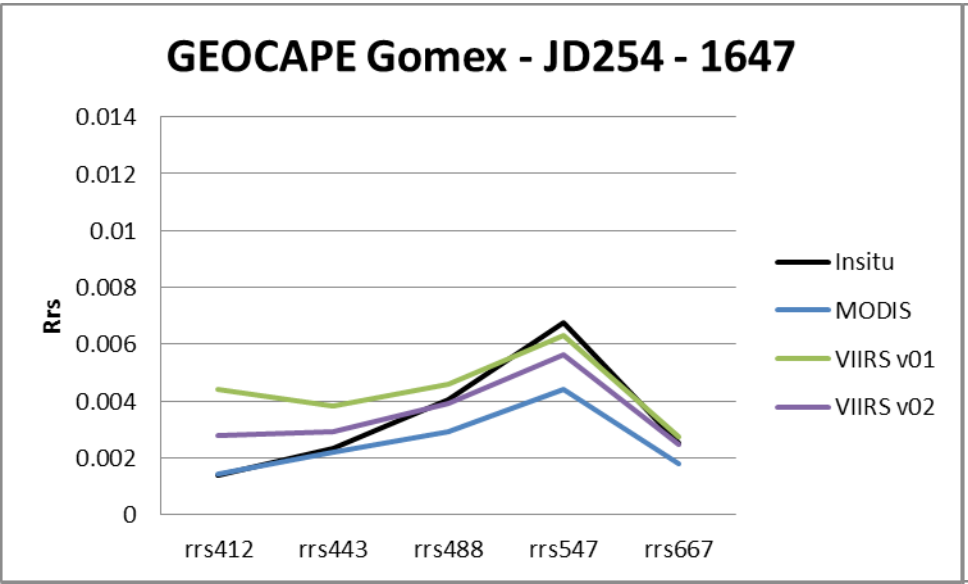

A. MODIS (1855 GMT)
AL
MS
FL
LA
B. SNPP VIIRS (1925 GMT)
AL
MS
FL
LA

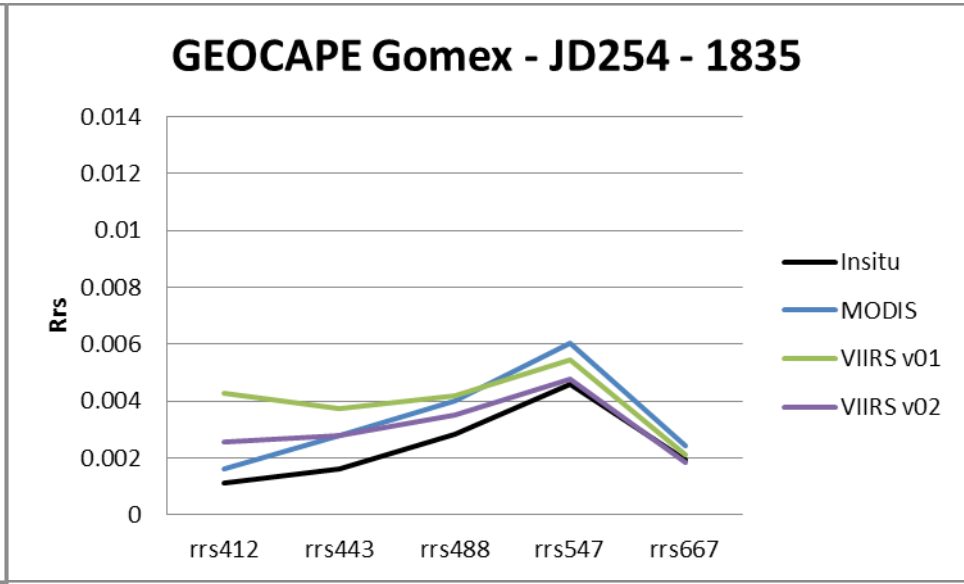
OCAPE / Northern Gulf of Mexico Cruise September 9-19, 2013
Rrs and IOP Station Locations

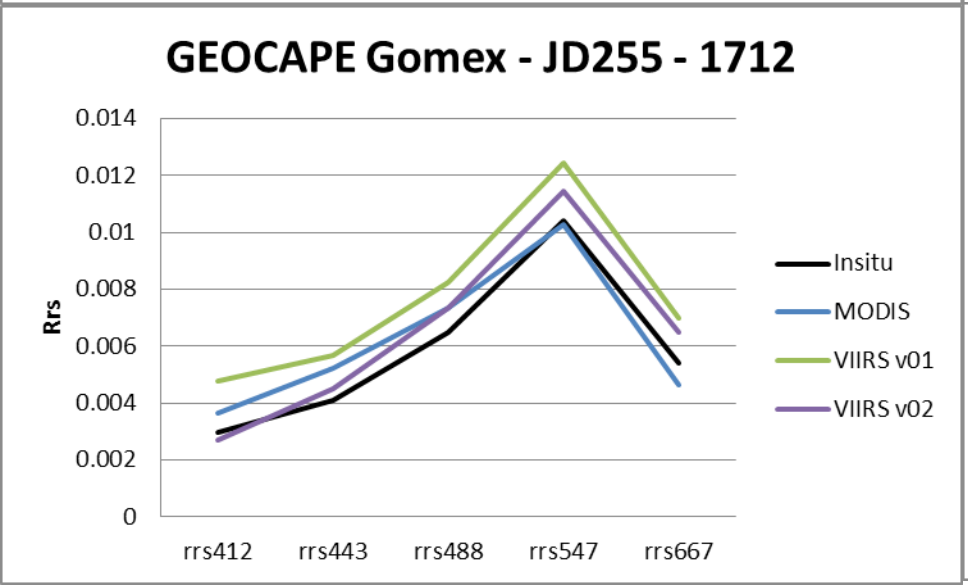


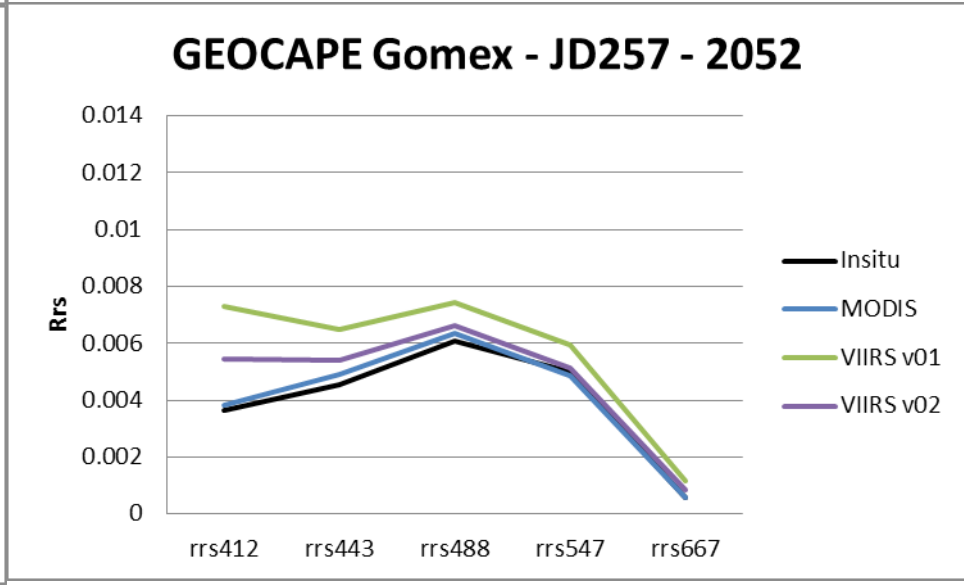
Insitu: UMASS/NOAA

EOCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Spectr

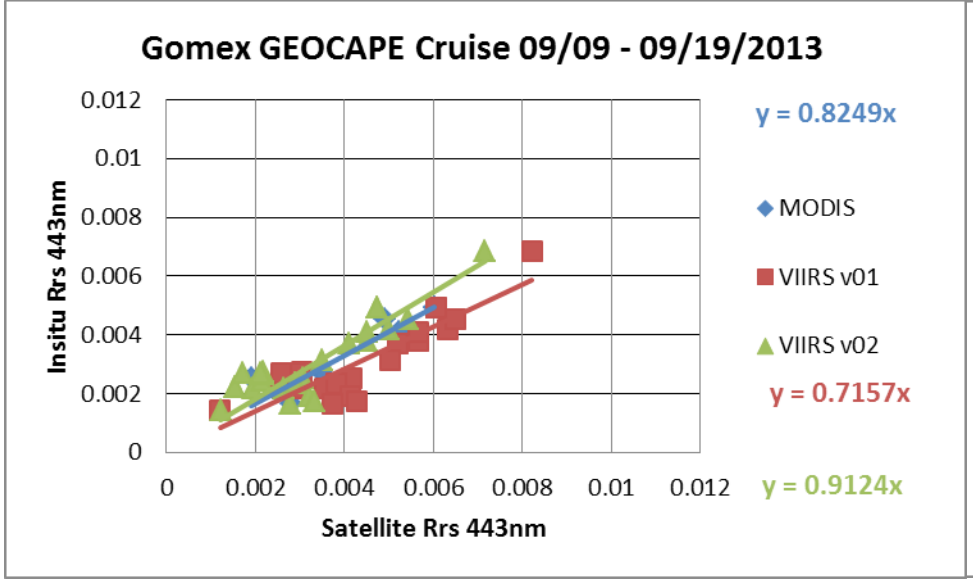


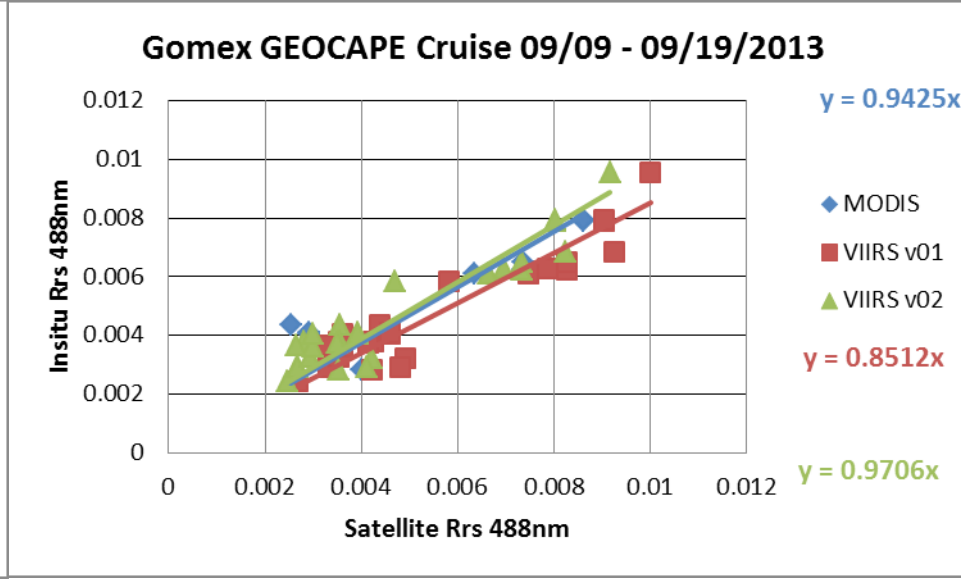


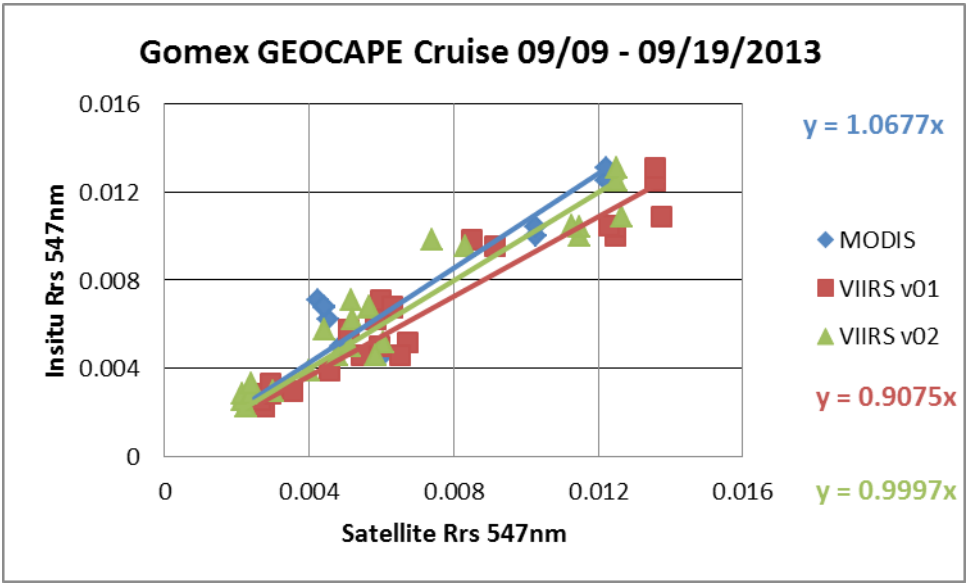




Insitu: UMASS/NOAA







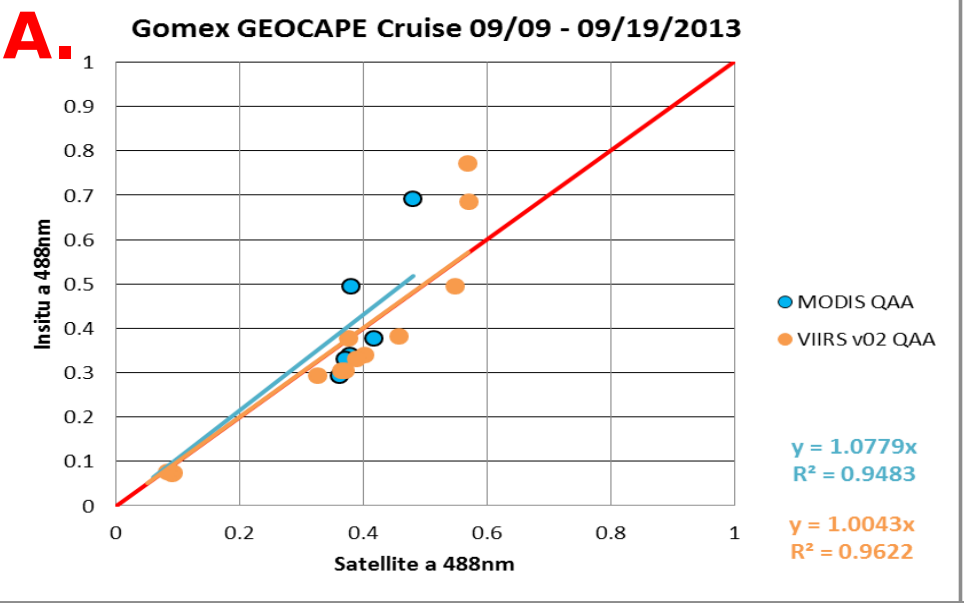
Slope	rrs412	rrs443	rrs488	rrs547	rrs667
MODIS	0.85	0.82	0.94	1.07	1.18
VIIRSv01	0.5	0.72	0.85	0.91	0.79
VIIRSv02	0.79	0.91	0.97	0.99	0.85

Rsquared	rrs412	rrs443	rrs488	rrs547	rrs667
MODIS	0.9852	0.9800	0.9692	0.9713	0.9720
VIIRSv01	0.9059	0.9668	0.9841	0.9826	0.9582
VIIRSv02	0.8768	0.9638	0.9801	0.9788	0.9573

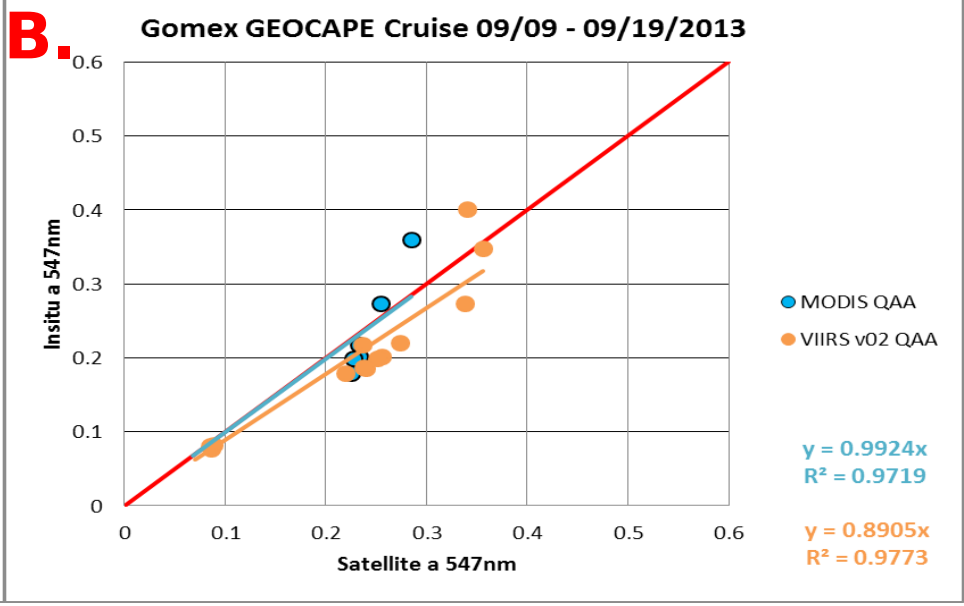
UMASS (Lee) & NOAA (Ondrusek)

25 Valid Match

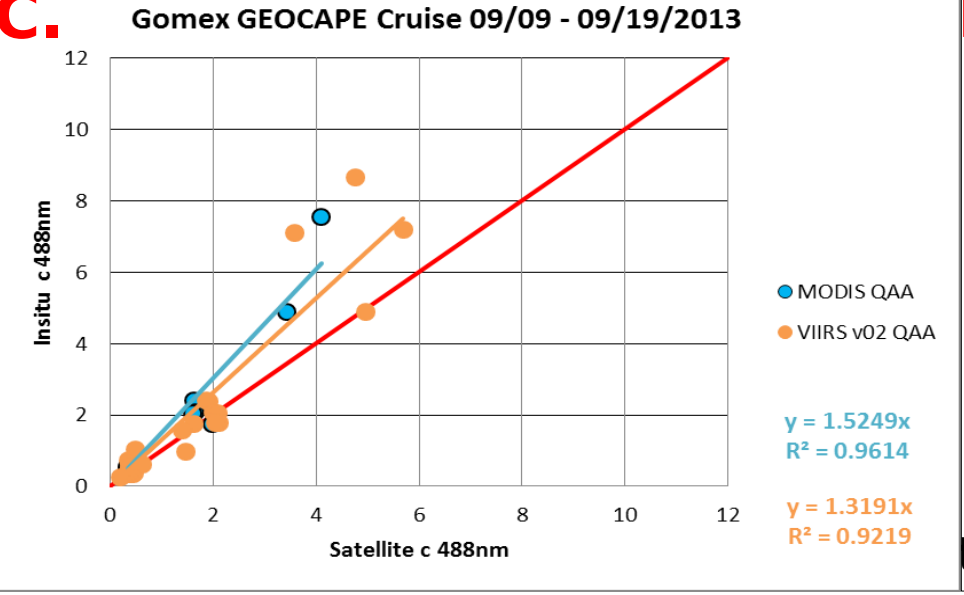
A.



B.



C.

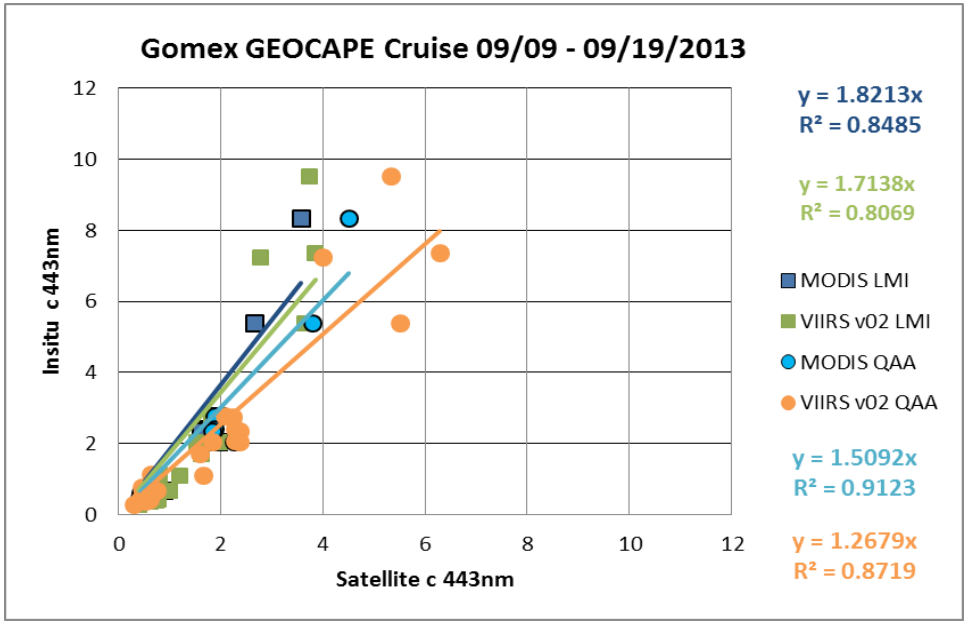


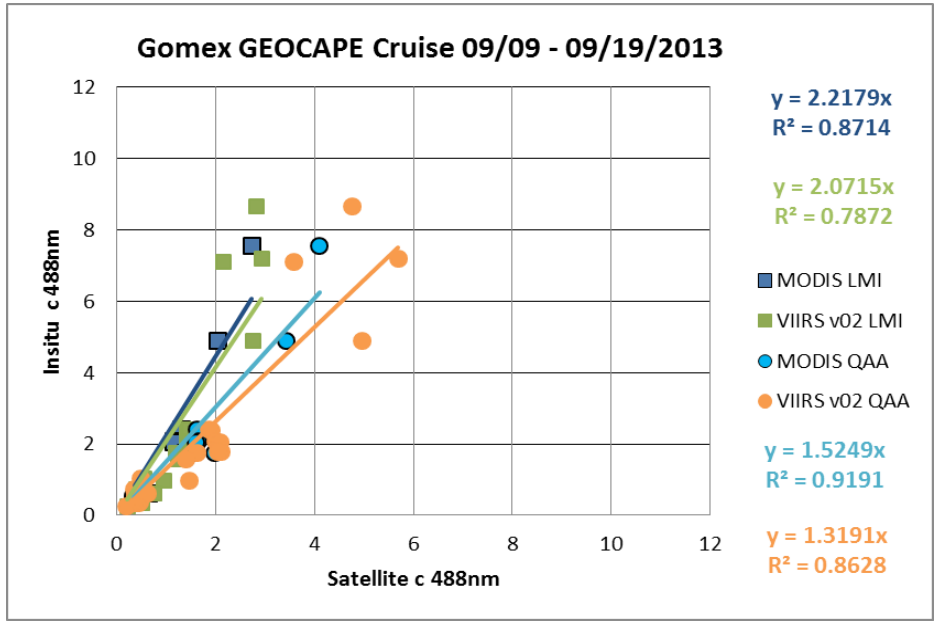
D.

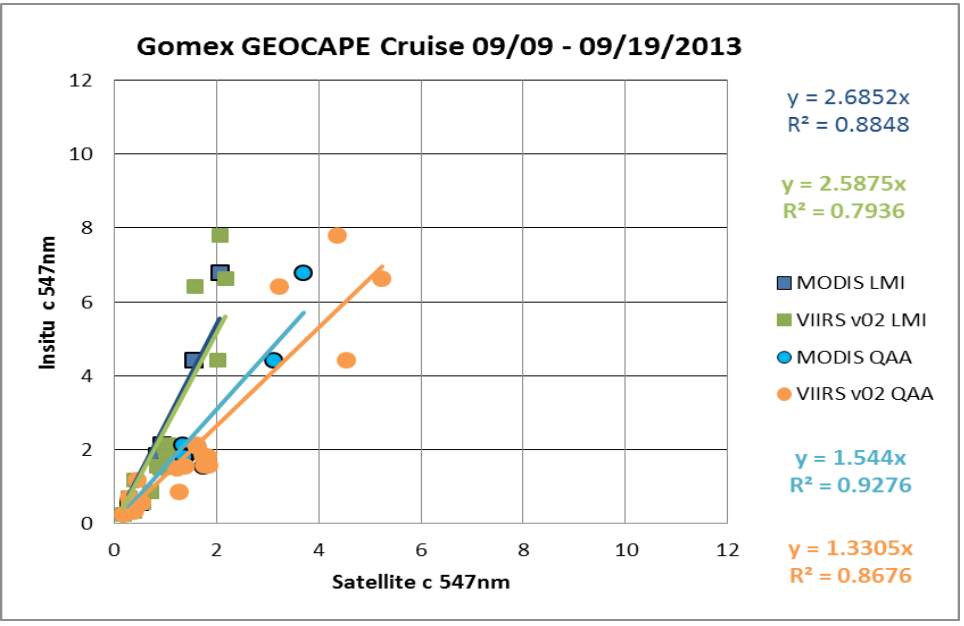
SLOPE	a412	a443	a488	a547	c412	c443	c488	c547
ModQAA	1.24	1.30	1.08	0.99	1.41	1.51	1.52	1.54
VIIRSQAA	1.21	1.32	1.00	0.89	1.11	1.27	1.32	1.33
R2	a412	a443	a488	a547	c412	c443	c488	c547
ModQAA	0.93	0.96	0.95	0.97	0.95	0.96	0.96	0.97
VIIRSQAA	0.93	0.88	0.96	0.97	0.92	0.93	0.92	0.93

tu: UMASS (Lee) & NOAA (Ondrusek

OCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Scatter



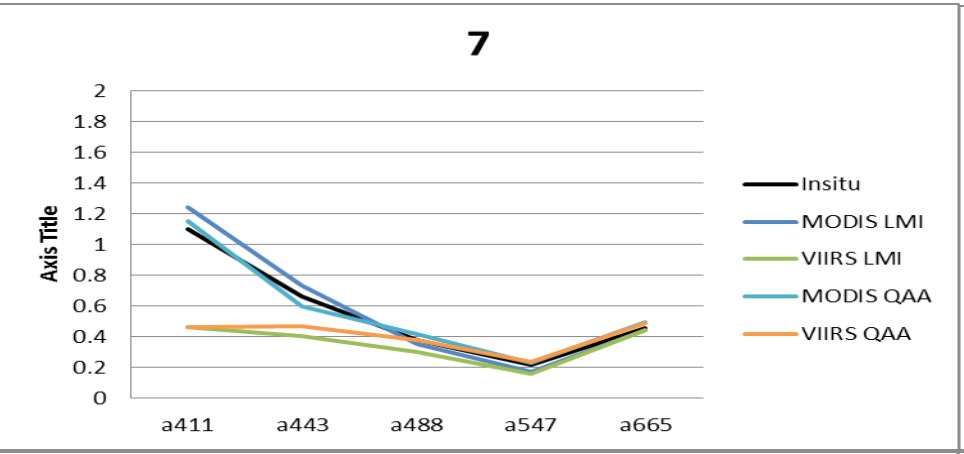


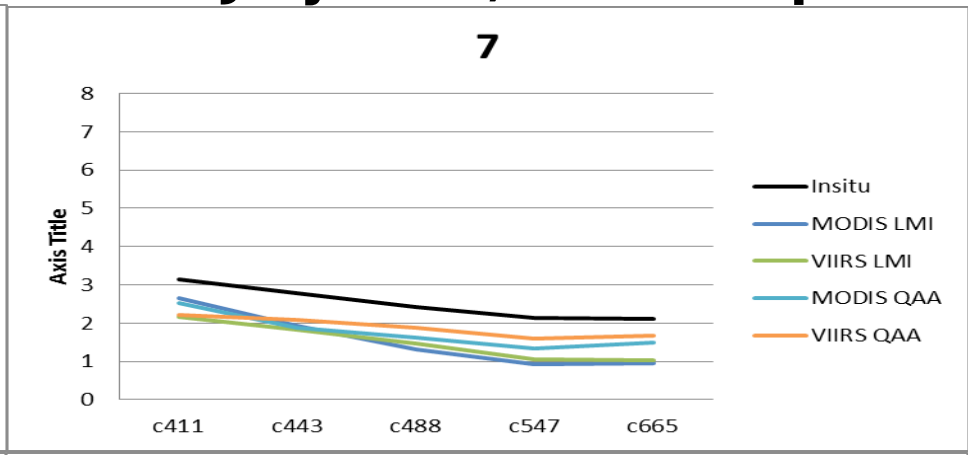


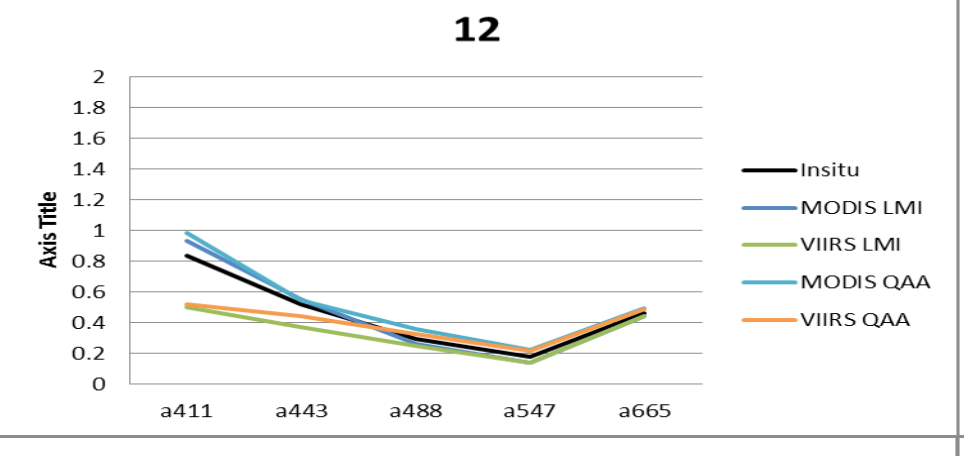
SLOPE	a412	a443	a488	a547	c412	c443	c488	c547
ModLMI	1.27	1.28	1.45	1.56	1.56	1.82	2.22	2.69
ModQAA	1.24	1.30	1.08	0.99	1.41	1.51	1.52	1.54
VIIRS LMI	1.42	1.66	1.40	1.51	1.33	1.71	2.07	2.59
VIIRS QAA	1.21	1.32	1.00	0.89	1.11	1.27	1.32	1.33
R2	a412	a443	a488	a547	c412	c443	c488	c547
ModLMI	0.01	0.02	0.05	0.06	0.91	0.92	0.94	0.95
ModQAA	0.20	0.78	0.75	0.99	0.92	0.93	0.93	0.93
VIIRS LMI	0.75	0.68	0.68	0.55	0.88	0.88	0.85	0.85
VIIRS QAA	0.79	0.73	0.87	0.87	0.86	0.88	0.87	0.87

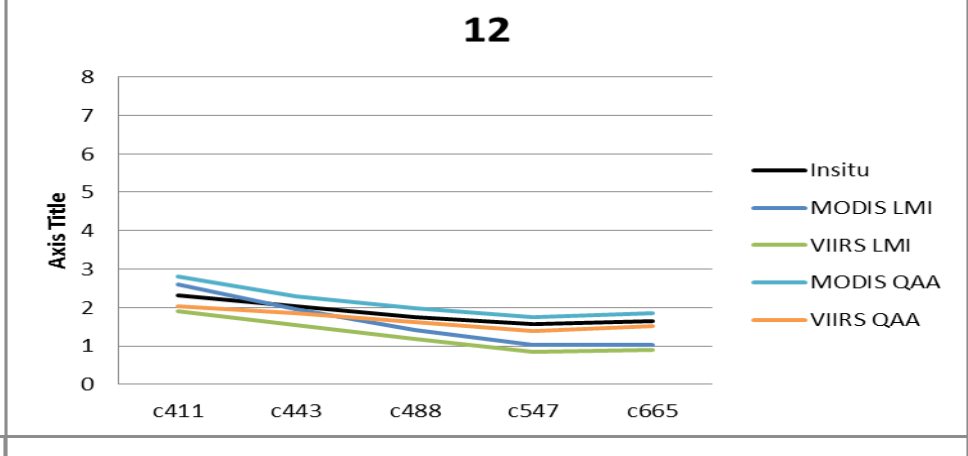
Insitu: UMASS/NOAA

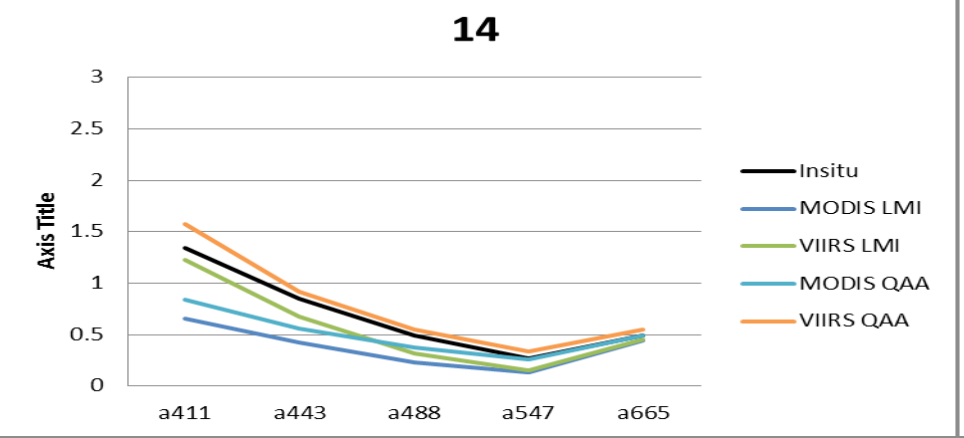
OCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Spectra

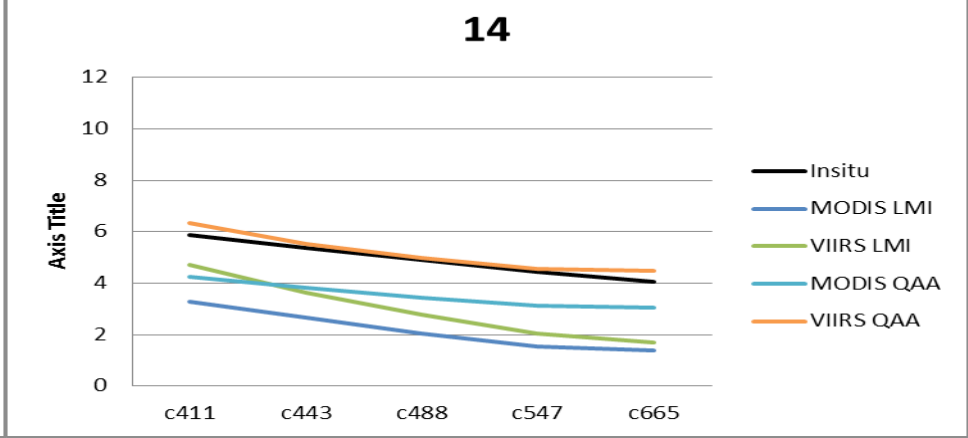


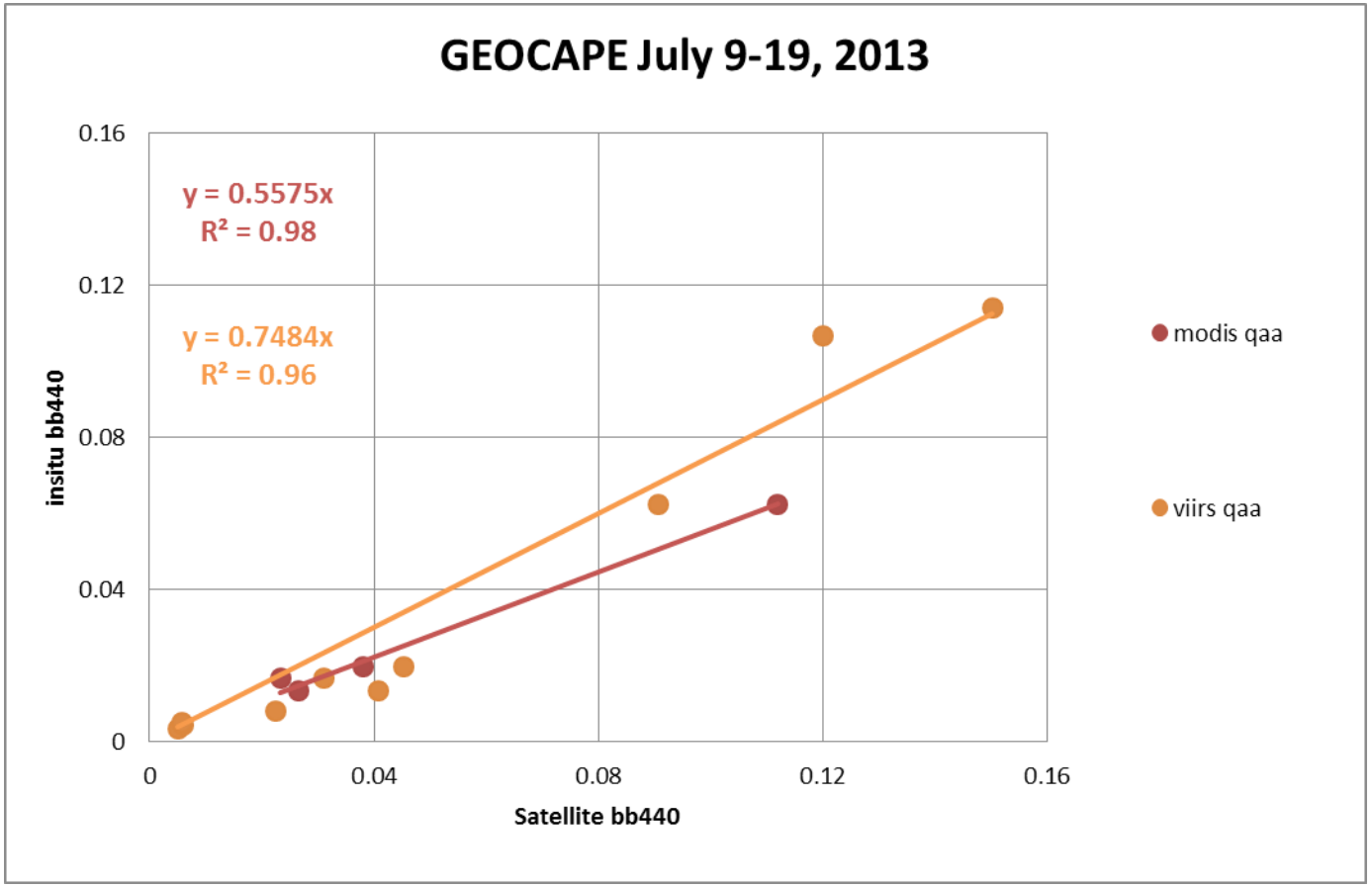








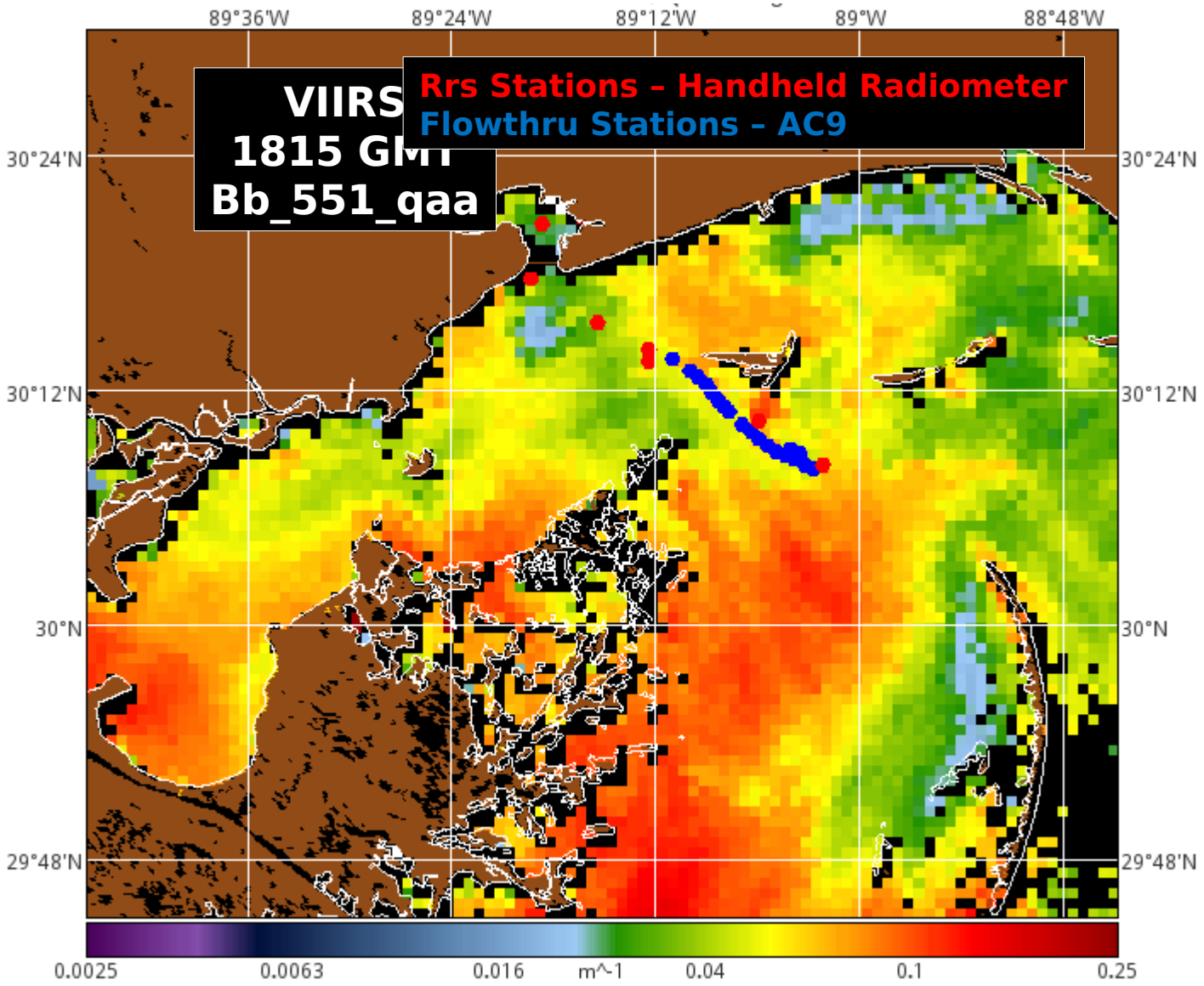




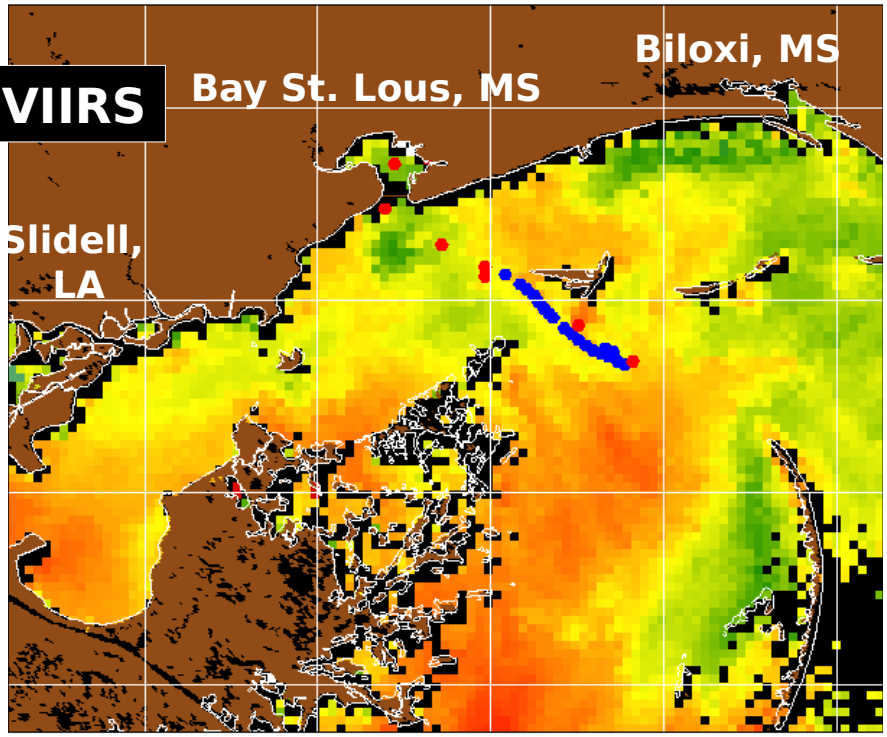
NOAA ECOPUC Data (Ondrusek)

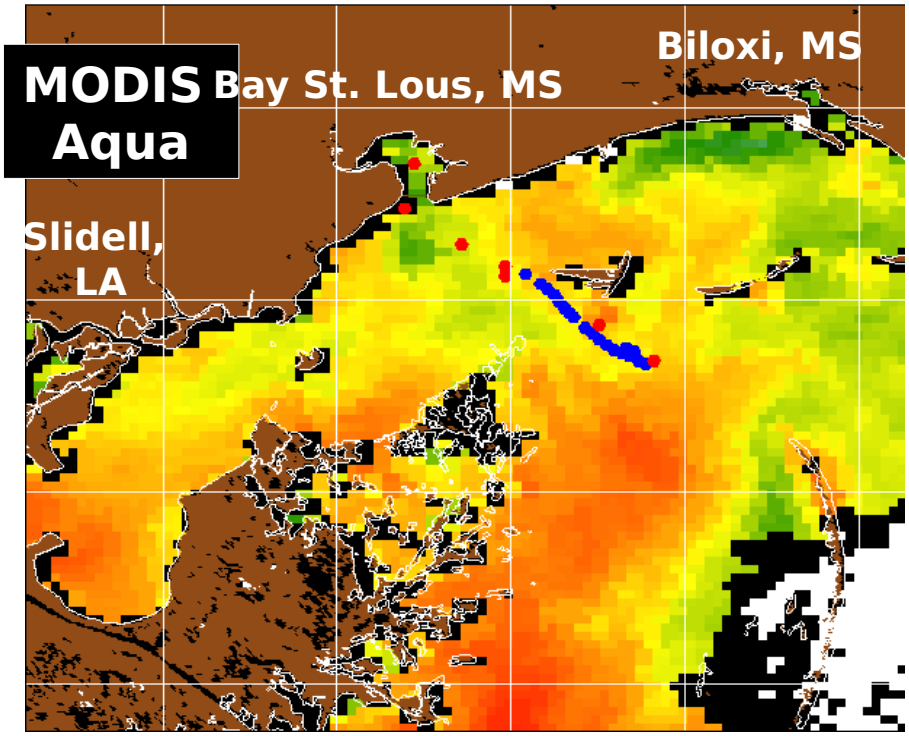
bb440	Rsquared	Slope
modis qaa	0.9895	0.5600
viirs qaa	0.9586	0.7500

cean Color Cruise – November 20, 2013 – Mississippi S
and IOP (Surface FlowThru +/- 30 Minutes from Satell

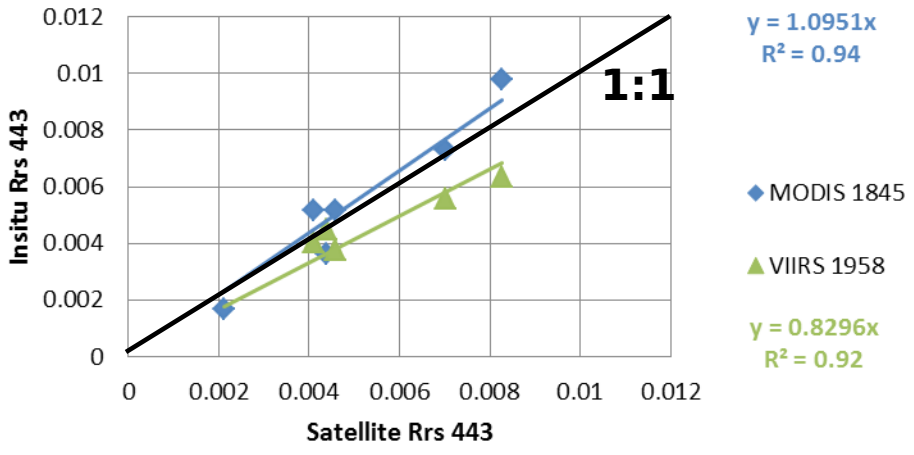


Comparison Between MODIS and VIIRS - November 20, 2013
Mississippi Sound
QAA Total Backscattering (551nm for VIIRS & 547nm for MODIS Aqua)

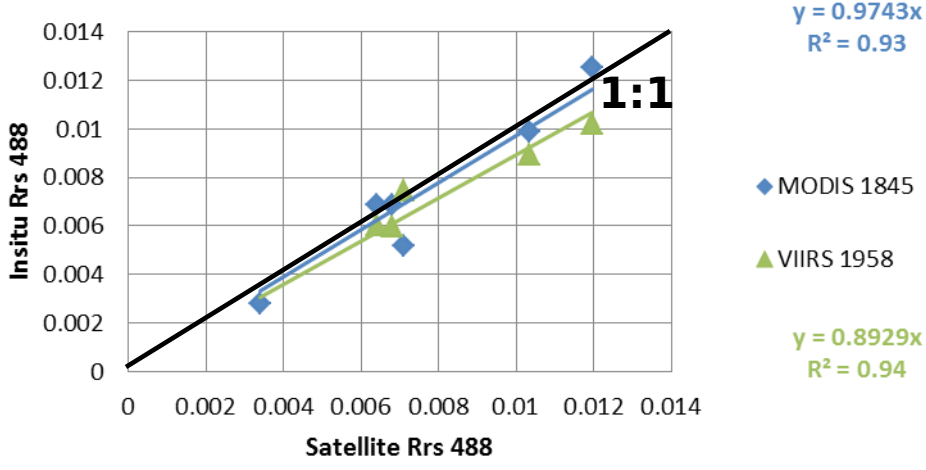




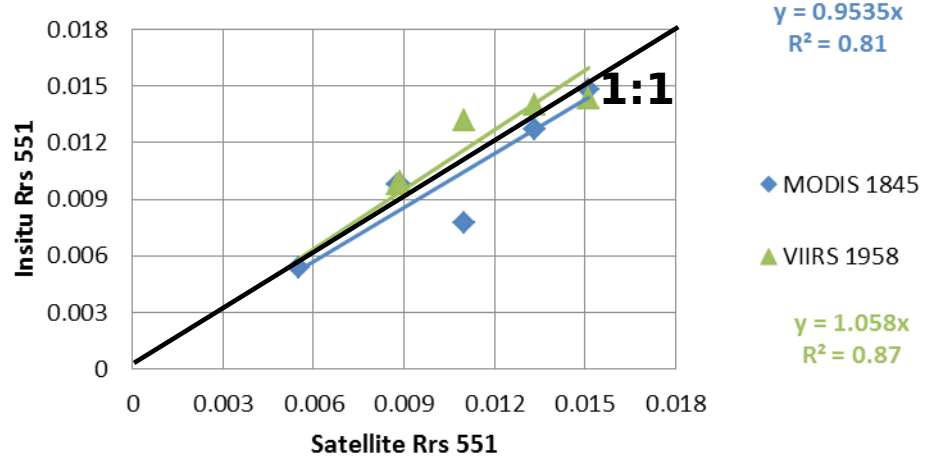
A.



B.



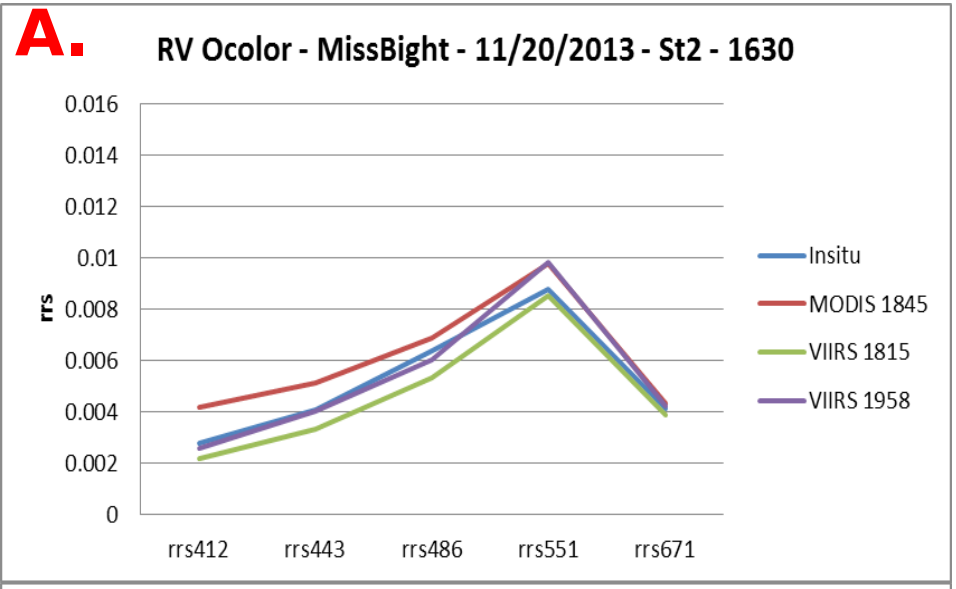
C.



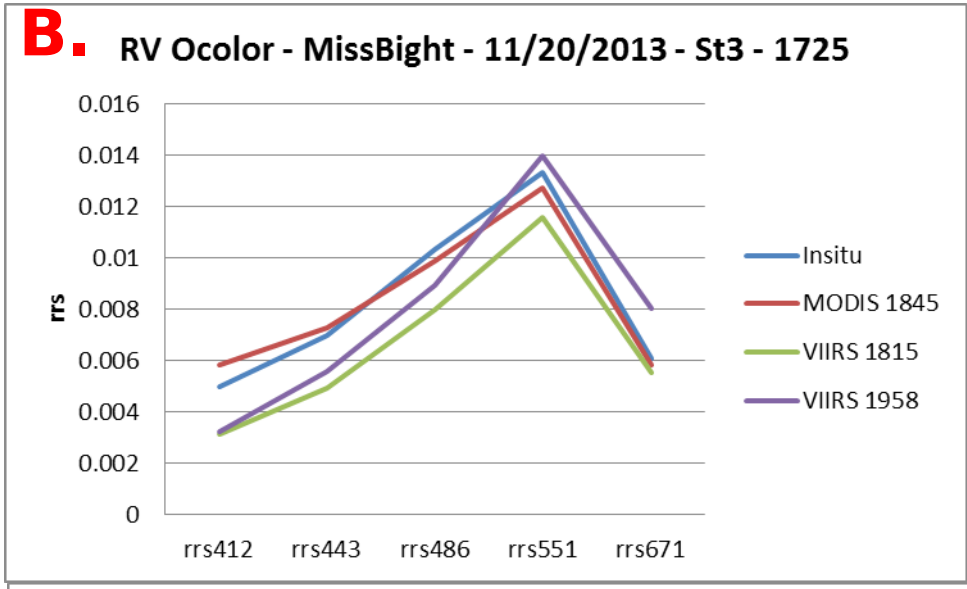
D.

Slope	rrs443	rrs488	rrs547
MODIS 1845	1.09	0.97	0.95
VIIRS 1957	0.83	0.89	1.06
Rsquared	rrs443	rrs488	rrs547
MODIS 1845	0.94	0.93	0.81
VIIRS 1957	0.92	0.94	0.87

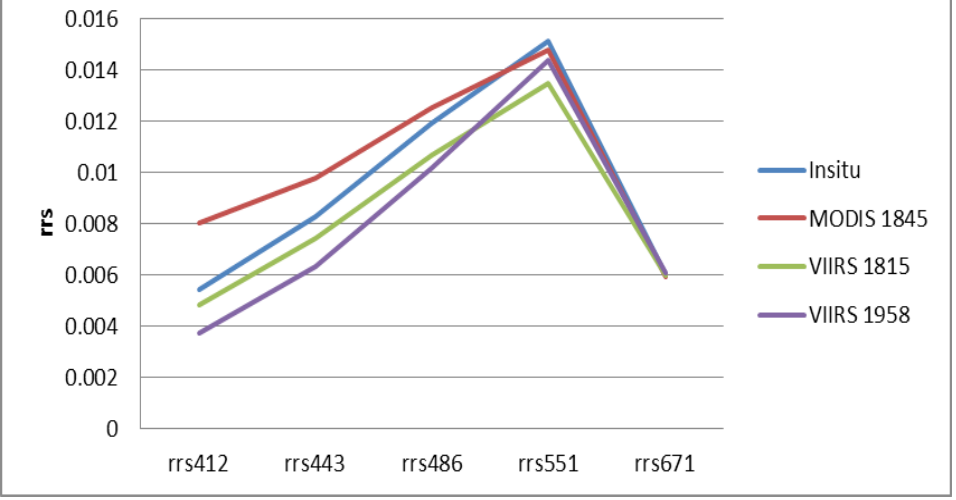
A.


RV Ocolor - MissBight - 11/20/2013 - St2 - 1630
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
rrs
rrs412
rrs443
rrs486
rrs551
rrs671
Insitu
MODIS 1845
VIIRS 1815
VIIRS 1958

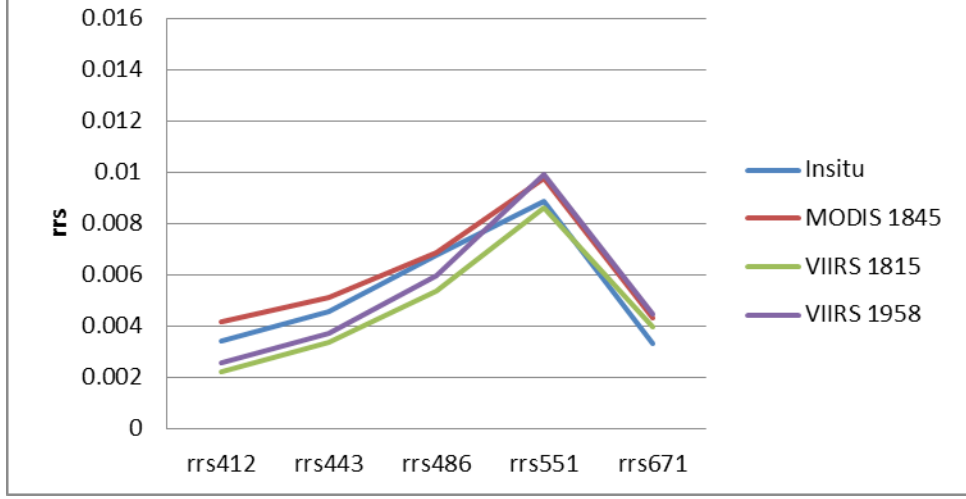
B.


RV Ocolor - MissBight - 11/20/2013 - St3 - 1725
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
rrs
rrs412
rrs443
rrs486
rrs551
rrs671
Insitu
MODIS 1845
VIIRS 1815
VIIRS 1958

C.

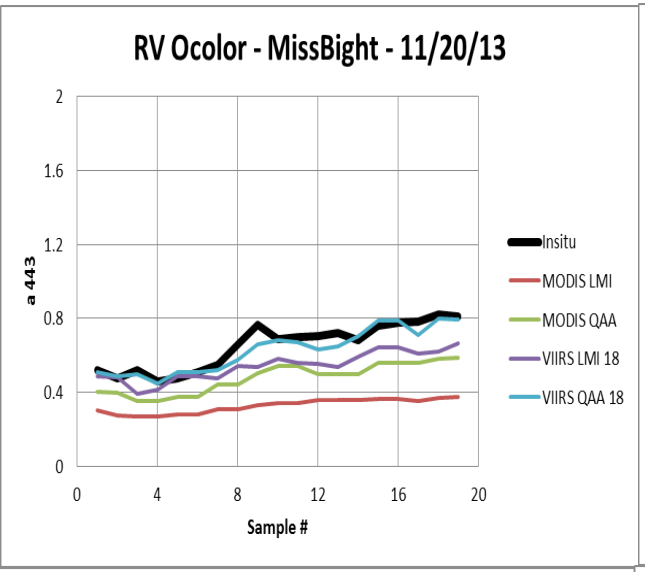

RV Ocolor - MissBight - 11/20/2013 - St4 - 1805
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
rrs
rrs412
rrs443
rrs486
rrs551
rrs671
Insitu
MODIS 1845
VIIRS 1815
VIIRS 1958

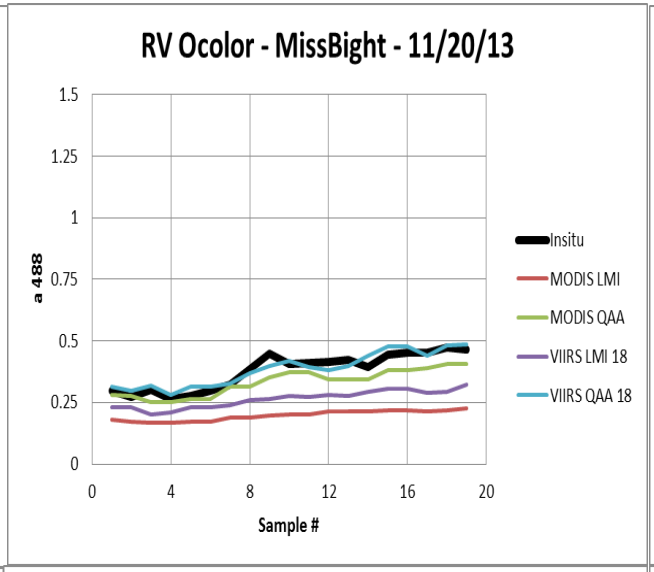
D.

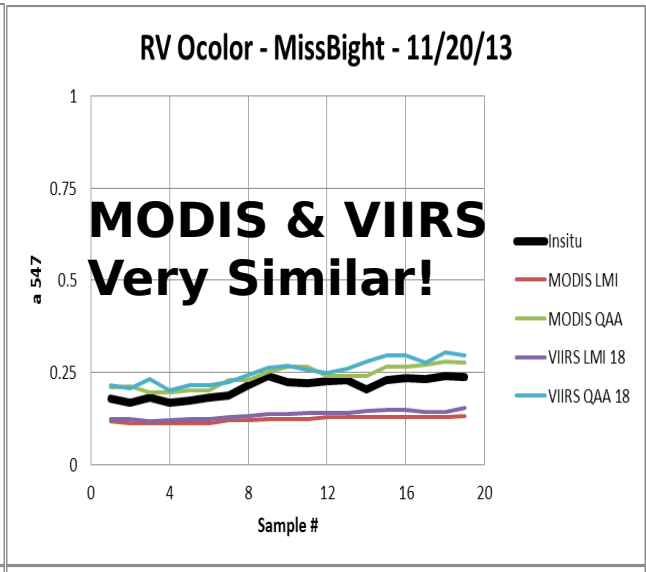

RV Ocolor - MissBight - 11/20/2013 - St5 - 1920
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
rrs
rrs412
rrs443
rrs486
rrs551
rrs671
Insitu
MODIS 1845
VIIRS 1815
VIIRS 1958

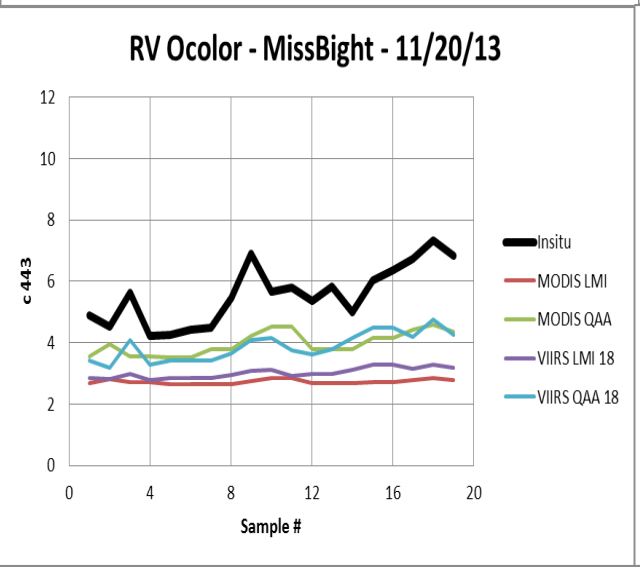
R/V Ocean Color Cruise Mississippi Sound November 20, 2013

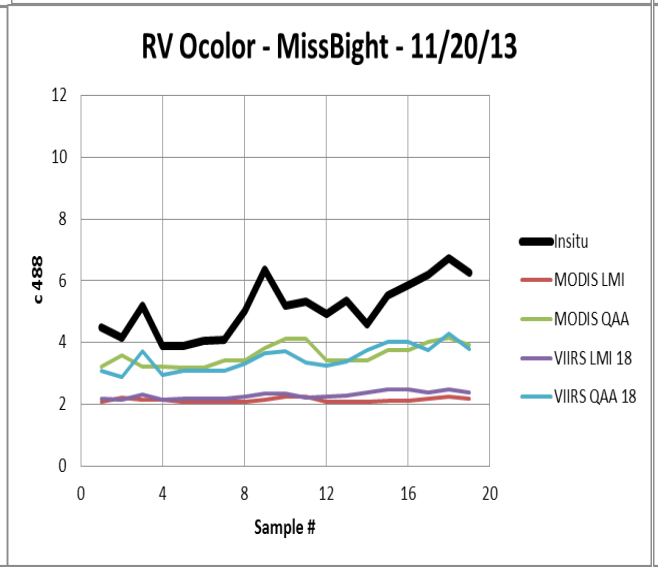
FlowThru (+/- 30 minutes of early/late satellite pass)

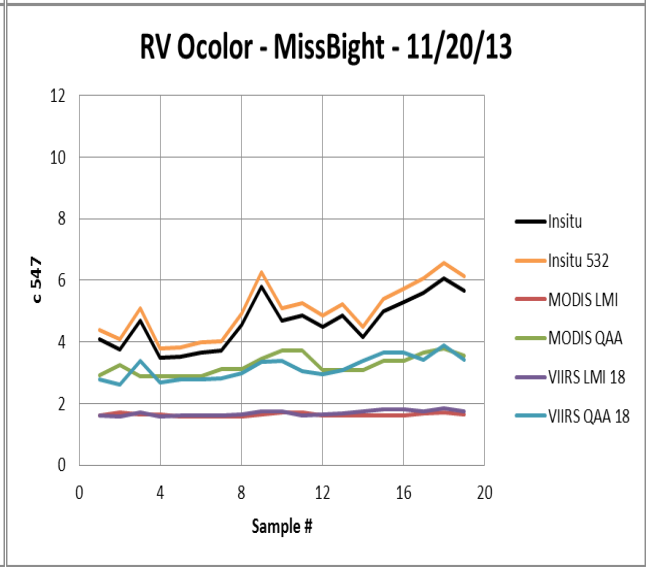






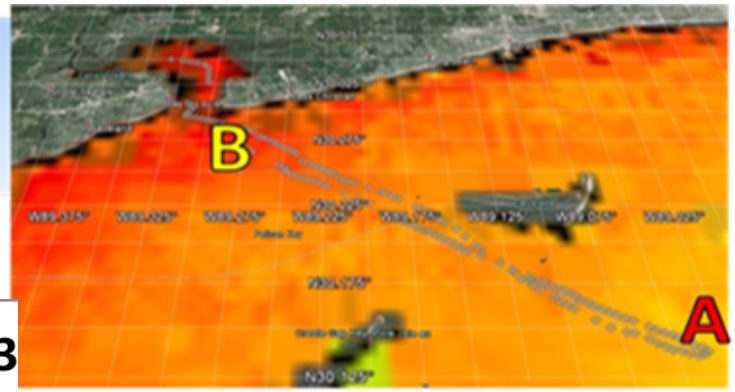


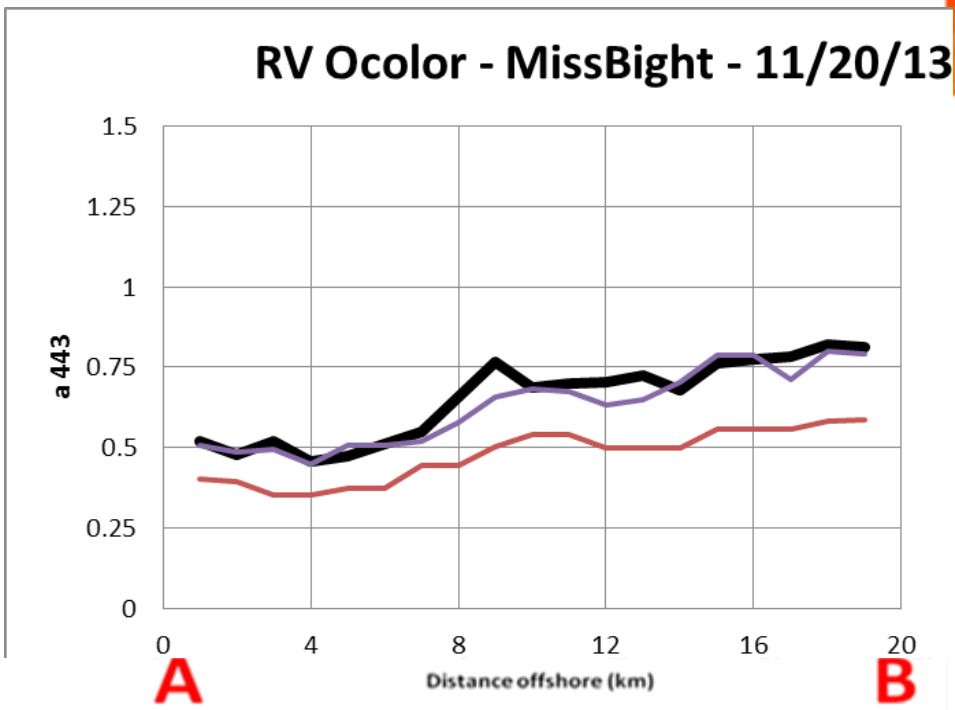


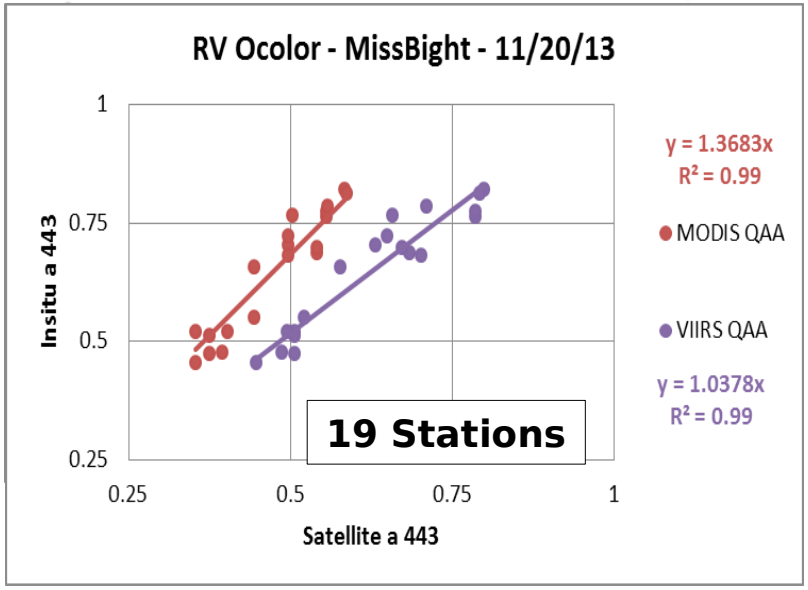


Satellite bb/b **Insitu profile bb/b**

Flowthrough IOPs –Total absorption (443 nm)



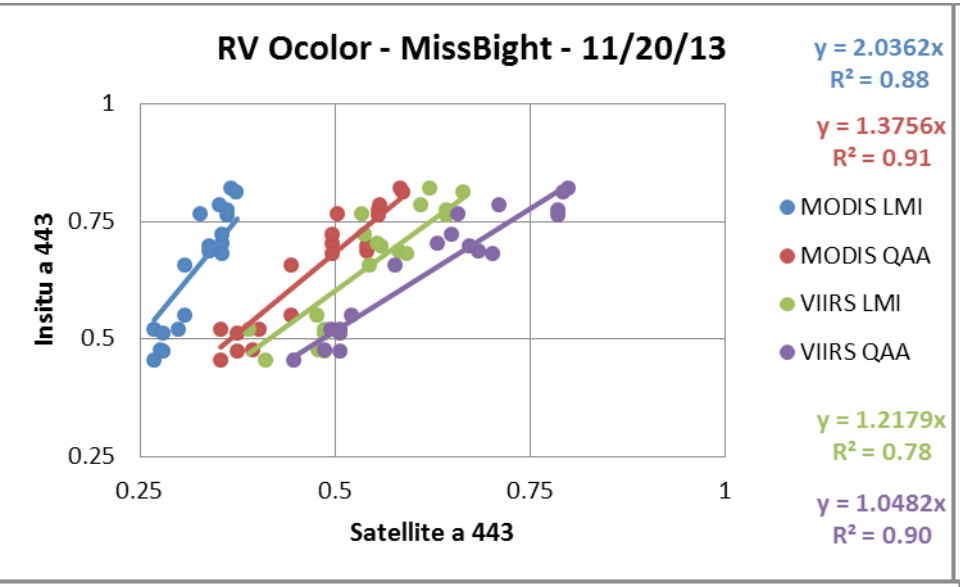


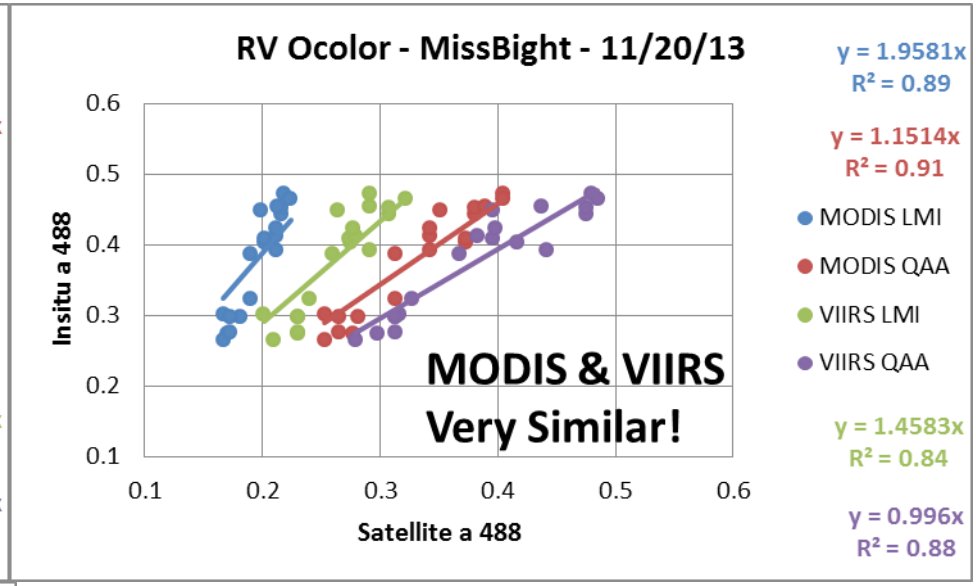


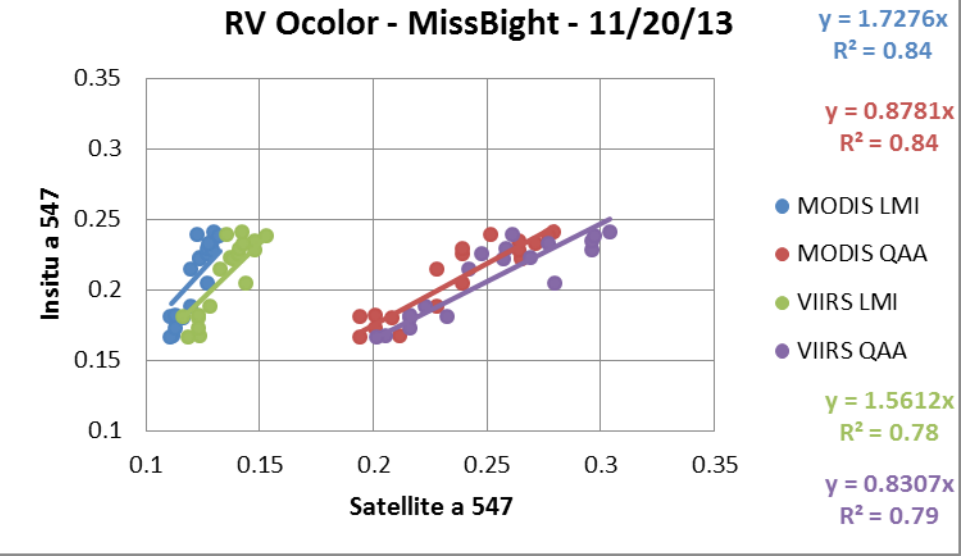
SLOPE	a412	a443	a488	a547	c412	c443	c488	c547
ModQAA	1.4719	1.3683	1.1459	0.8762	1.3836	1.4048	1.4270	1.4263
VIIRS QAA	0.8398	1.0374	0.9853	0.8244	1.3357	1.4410	1.4748	1.4678
R2	a412	a443	a488	a547	c412	c443	c488	c547
ModQAA	0.9968	0.9966	0.9961	0.9974	0.9875	0.9872	0.9871	0.9873
VIIRS QAA	0.9929	0.9966	0.9958	0.9965	0.9915	0.9914	0.9908	0.9909

R/V Ocean Color Cruise Mississippi Sound November 20, 2013

FlowThru (+/- 30 minutes of early/late satellite pass)





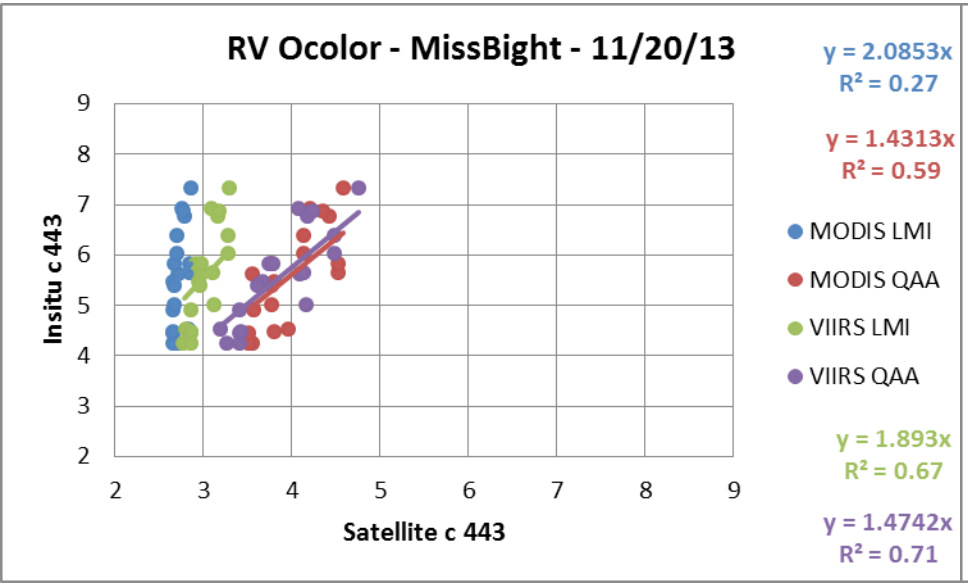


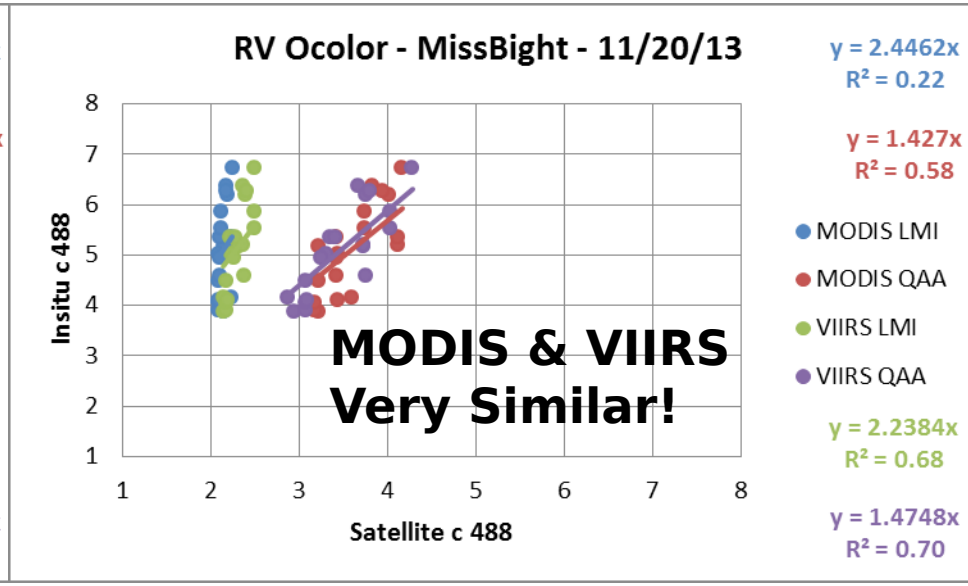
SLOPE	a412	a443	a488	a547
ModLMI	1.95	2.03	1.96	1.73
ModQAA	1.48	1.38	1.15	0.88
VIIRSLMI	0.93	1.22	1.46	1.56
VIIRSQAA	0.85	1.05	0.99	0.83

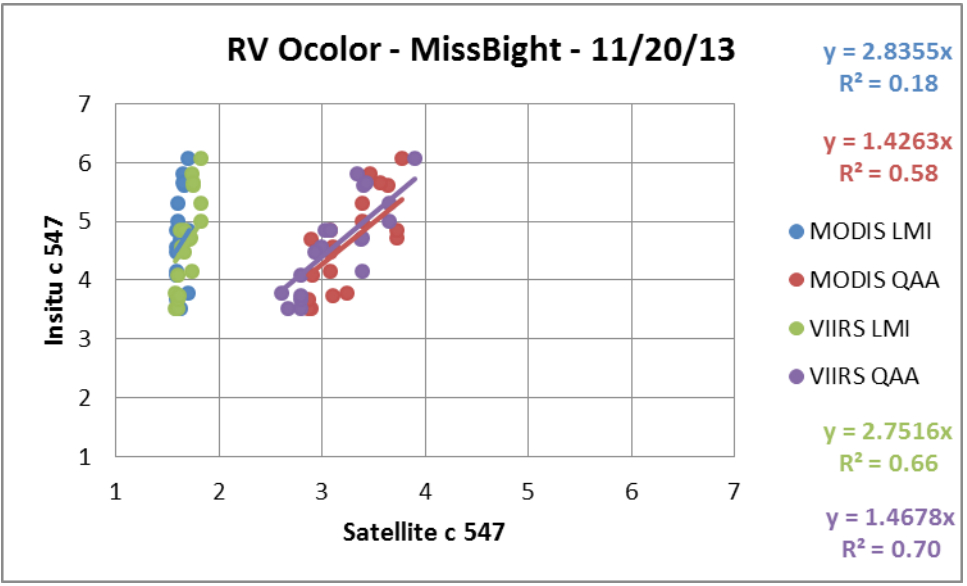
R2	a412	a443	a488	a547
ModLMI	0.86	0.88	0.89	0.84
ModQAA	0.90	0.91	0.91	0.84
VIIRSLMI	0.72	0.78	0.84	0.78
VIIRSQAA	0.80	0.90	0.88	0.79

R/V Ocean Color Cruise Mississippi Sound November 20, 2013

FlowThru (+/- 30 minutes of early/late satellite pass)







SLOPE	c412	c443	c488	c547
ModLMI	1.84	2.09	2.45	2.84
ModQAA	1.41	1.43	1.43	1.43
VIIRSLMI	1.56	1.89	2.24	2.75
VIIRSQAA	1.37	1.47	1.48	1.47

R2	c412	c443	c488	c547
ModLMI	0.31	0.27	0.22	0.18
ModQAA	0.59	0.59	0.58	0.58
VIIRSLMI	0.67	0.69	0.68	0.66
VIIRSQAA	0.71	0.72	0.70	0.70

Evaluation of GOCI, MODIS, and VIIRS Imagery
Objective

- Evaluate current NRL processing of GOCI level 1b water leaving radiance (nL_w)
- Provide an inter-sensor comparison between GOCI, MODIS, and VIIRS remote sensing reflectances
- Compare GOCI, MODIS, and VIIRS with East China Sea Aeronet Ocean Color (Gageocho and Ieodo) data

2014 AGU OCEAN SCIENCES (Crout, et.al.)

Evaluation of GOCI, MODIS, and VIIRS Imagery
Background - Data

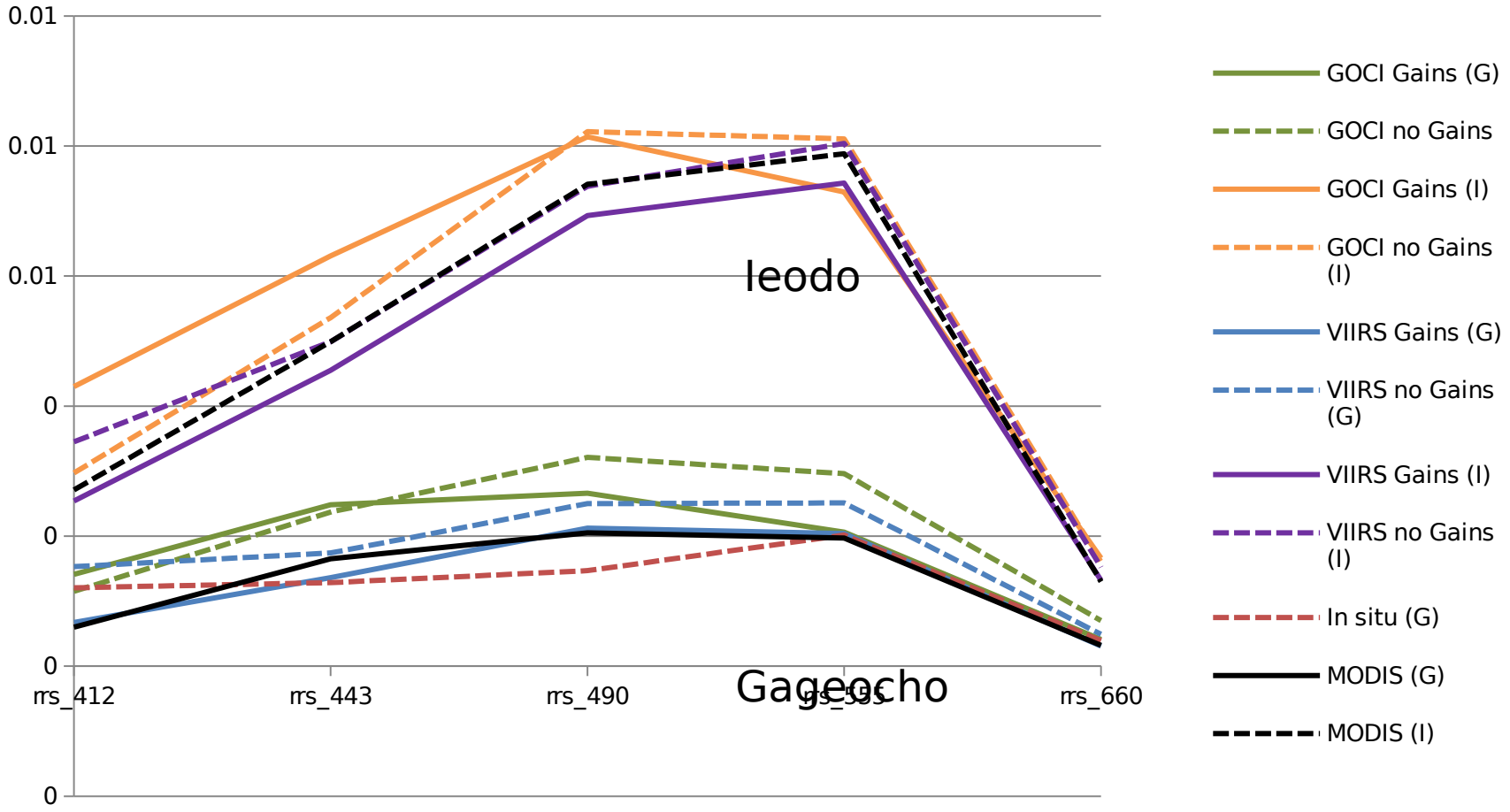
- MODIS
  - Processed with MOBY gains
- VIIRS
  - Processed with MOBY gains
- GOCI
  - Processed with MODIS-SWIR-derived vicarious calibration gains
  - GOCI data from 4Z GTM (corresponds to local 1 pm)
    - Reduces sun glint and sensor issues
- Aeronet SeaPrism
  - Gageocho Aeronet (SeaPrism #624) was moved to Ieodo
    - Results in a data gap from May 2012 – December 2013
    - The quality control of the data is near real time?

Evaluation of GOCI, MODIS, and VIIRS Imagery
Background - Processing

- Operational Ocean Color Processing
  - NRL's Automated Processing System (APS) based on n2gen software (NRL/NASA R&D)
  - Level 1b data obtained from NOAA CLASS (MODIS) and NAVO (GOCI and MODIS)
  - Atmospheric correction using Gordon-Wang NIR with 80 aerosol models
  - Glint and cloud removal

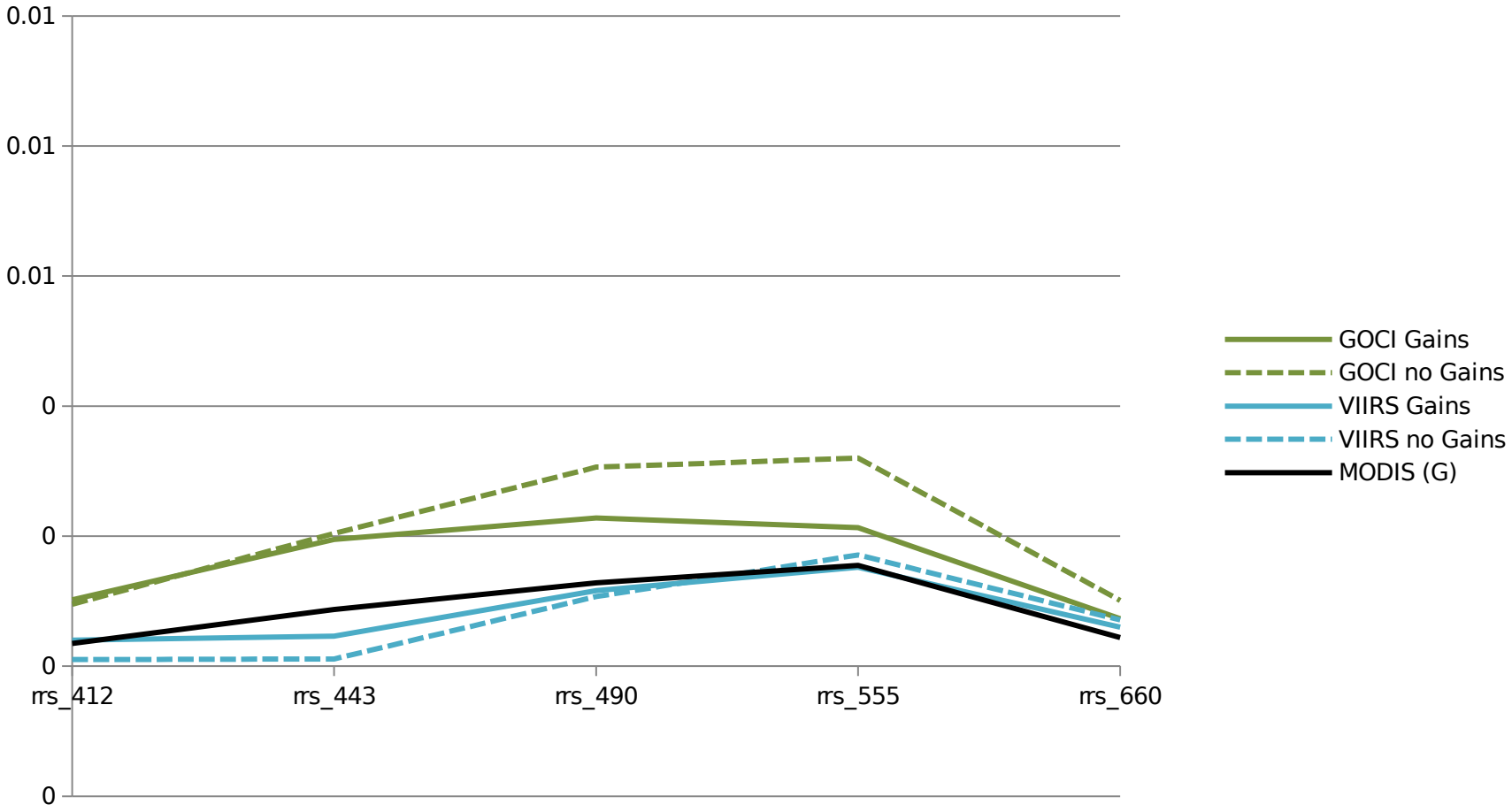
Evaluation of GOCI, MODIS, and VIIRS Imagery

JD 118 2012 Spectra – Gageocho and Ieodo



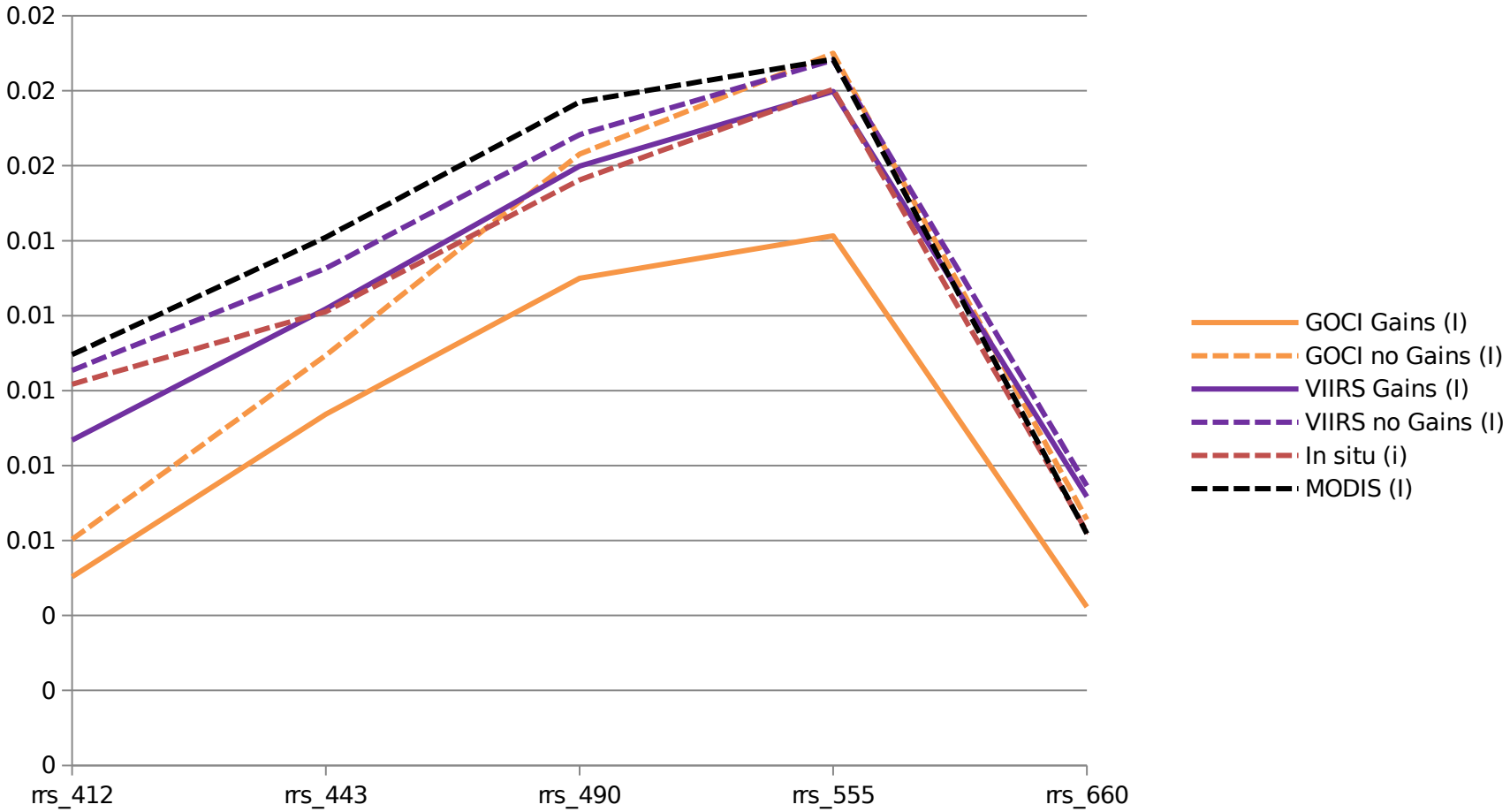
Evaluation of GOCI, MODIS, and VIIRS Imagery

JD 277 2013 Spectra – Gageocho



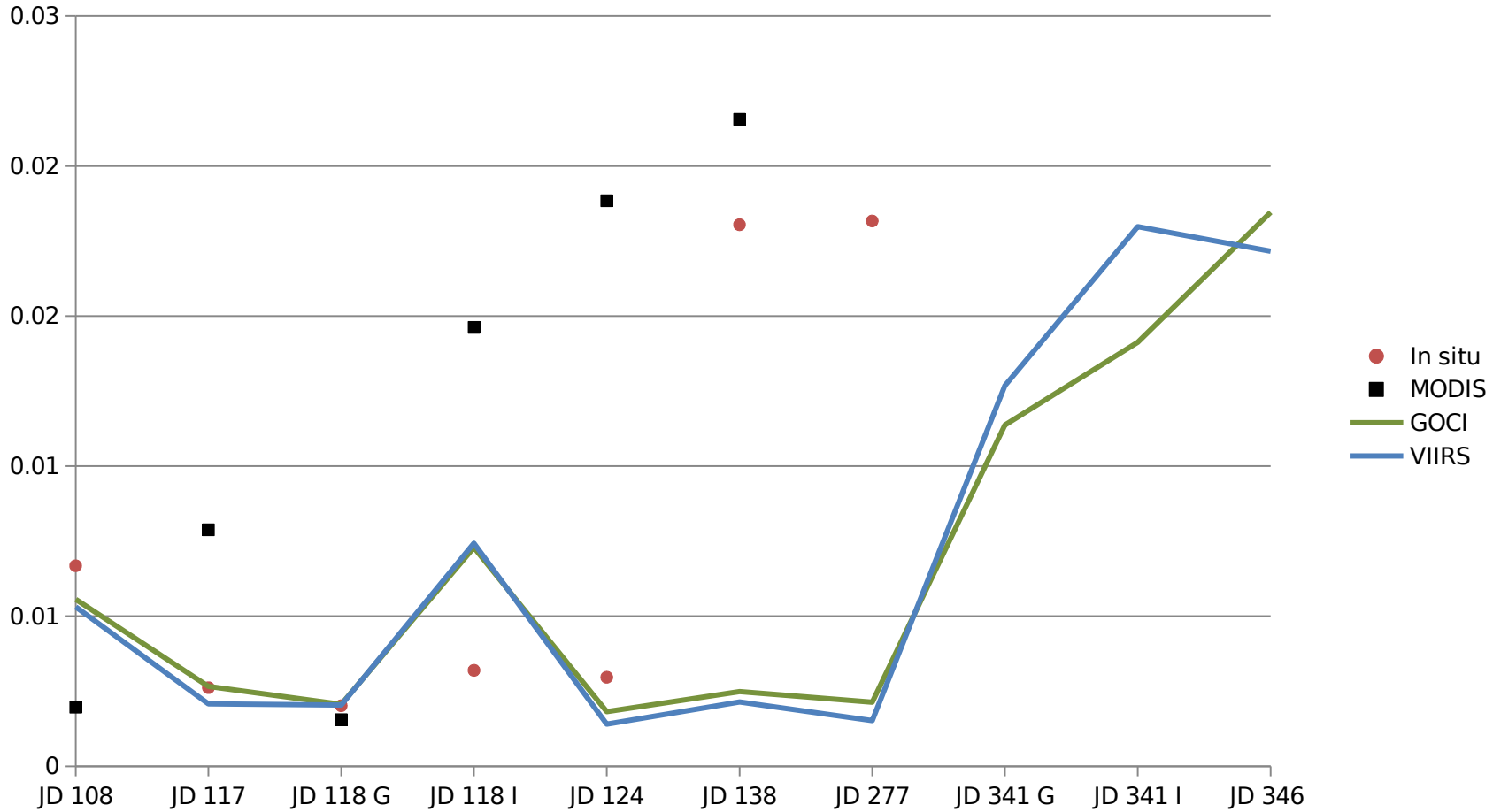
Evaluation of GOCI, MODIS, and VIIRS Imagery

JD 341 2013 spectra – leodo



Evaluation of GOCI, MODIS, and VIIRS Imagery

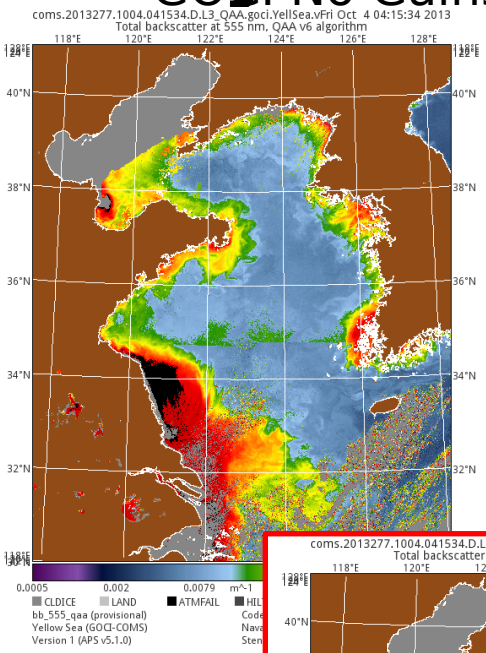
All sensors (4Z) time series - rrs 550



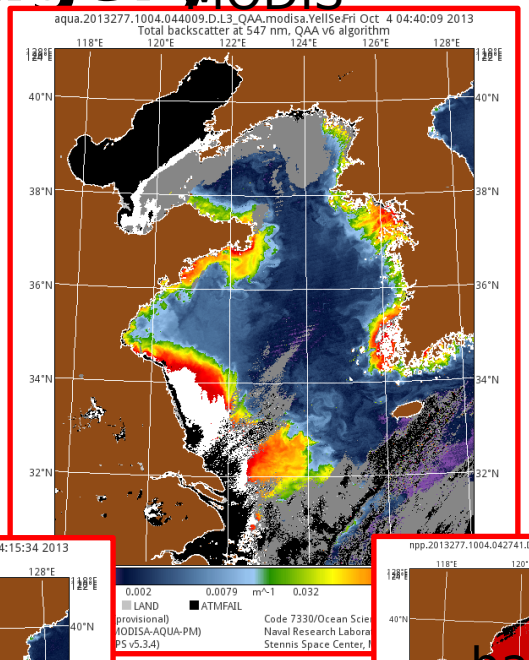
Evaluation of GOCI, MODIS, and VIIRS Imagery - bb 551nm

JD 277 Imagery

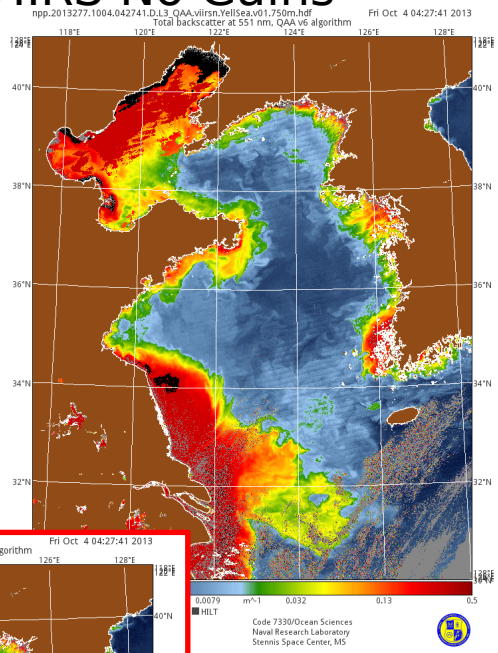
GOCI No Gains



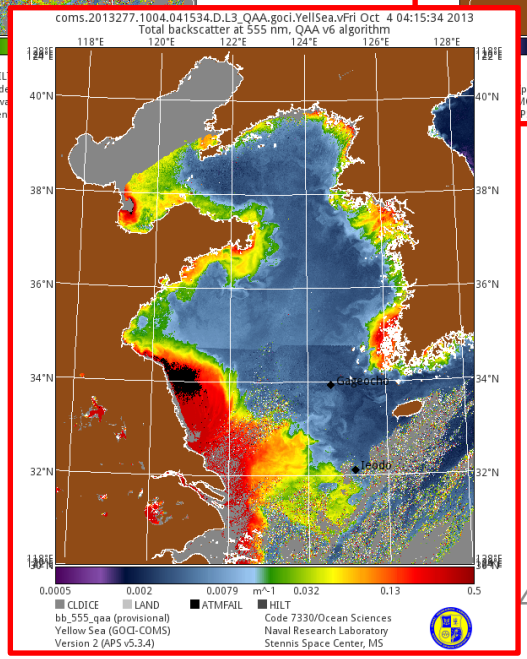
MODIS



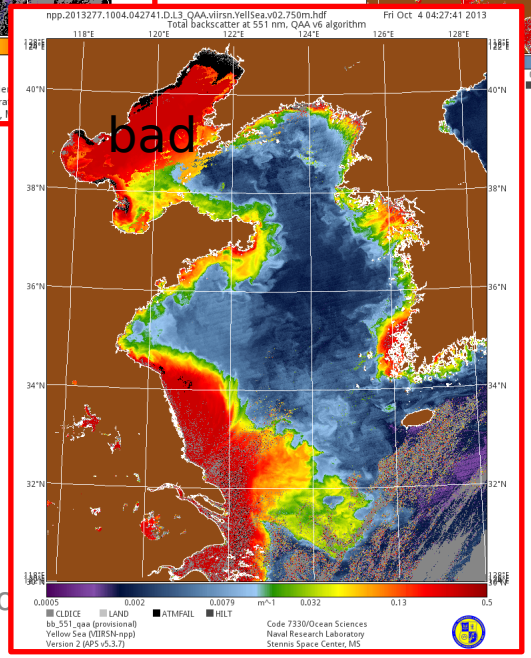
VIIRS No Gains



GOCI Gains



VIIRS Gains



JD 277 Full Image comparison to sites from multiple images - R^2 Values

R^2 Values	Multiple Images, Single Sample		Single Image, all samples	
Channel	GOCI-MODIS	VIIRS-MODIS	GOCI-MODIS	VIIRS-MODIS
412	0.539	0.970	0.842	0.942
443	0.835	0.993	0.943	0.971
490	0.930	0.992	0.976	0.985
555	0.980	0.979	0.983	0.990
690	0.959	0.914	0.972	0.983

ed to MODIS, VIIRS doing a little better overall than GOCI (mair
e sensors consistent.

Conclusions

- MODIS, VIIRS, and GOCI remote sensing reflectances compare favorably in the East China Sea
- Application of Gains to GOCI and VIIRS visibly improves data
- Application of Gains lowers rrs in most cases
  - GOCI 412 and 443 channels appear to be exceptions
- Data from single points and imagery show similar statistics, except at GOCI 412 and 443 Channels
- Overall, the comparison between the sensors are good